FORESTRY ABSTRACTS

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FORESTRY, HORTICULTURE AND THE MOON

By

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BELIEFS that the phases of the moon affect the rate of development of plants are both ancient and worldwide to-day. Not only is it believed that the moon can influence the success or failure of the sowing and harvesting of crops, but also a differential effect is ascribed to each of its phases, and the rural economy of primitive peoples is often entirely regulated by the lunar calendar. In forestry the moon is believed to affect felling and seasoning of timber and the yield of resin, gum, rubber and other forest products.

Proof by rational experiment seems to have been first sought over 250 years ago by La Quintinye, the horticulturist (1690), who was unconvinced of the existence of a lunar influence. His book, 'Instruction pour les jardins fruitiers et potagers', was published after his death and a more conservative editor, fearing the unpopularity of such lunar heresy, reinstated the moon in an appendix. Some years later, Duhamel du Monceau, the versatile writer on commercial processes, horticulture and forestry (1764), reviewed the beliefs in lunar influence current in his day among agriculturists and woodsmen, and after a series of simple experiments on trees concluded that they were fallacies. He gave as his opinion that '*il falloit abandonner toutes ces pratiques comme tout-à-fait ridicules, et absolument opposées à la bonne Physique*'. Since then scientific interest on the subject has been revived intermittently, either by the 'rediscovery' of lunar rites in the agriculture of civilized countries, or by the impact on Europeans of the impressive faith of primitive peoples, particularly in the tropics and sub-tropics. In consequence the literature on the moon and plant growth can be assigned to two groups: the one comprising reiterations of peasant beliefs, myths and rules, both ancient and modern, together with unsubstantiated statements of credulous travellers and observers: the other comprising experiments supported by numerical data capable of statistical analysis. This second group consists of (*a*) the experiments, mainly of the anthroposophical school, which demonstrate the existence of lunar effects on the growth of plants, and (*b*) the experiments of professional horticulturists and foresters which prove that there are no such effects, or that, if they do exist, they have no value in agricultural practice.

The beliefs which dominate primitive rural economy and the emphatic reports of credulous observers are very numerous. They provide no significant evidence for or against the assumptions and it would be unprofitable to recapitulate them here. Only experimental data need be considered and it is the purpose of this communication to summarize them briefly.

GROUP (*a*). KOLISKO'S WORK.

Date of sowing: There is an almost cosmopolitan belief that plants which yield above ground should be sown during the waxing moon, and that those which yield below ground (root crops) should be sown during the waning moon. Experiments conducted by Kolisko (1936) at the Biological Institute in the Goetheanum, Stuttgart, between 1926–35 have methodically tested these rules and have shown that the particular phase of the moon at the time of germination does influence the subsequent growth of the plant. The experimental data are presented in the form of graphical diagrams and photographs of selected 'typical' plants; numerical data are not published and do not appear to have been statistically analysed.

For leaf- and fruit-bearing crops such as cabbages, lettuces, beans, peas, tomatoes, and cucumbers the most favourable time to sow is 2 days before the full moon. These plants show better germination, more vigorous growth and considerably larger yield than plants from sowings made 2 days before the new moon. Sowings made in the waxing and the waning quarters also give better results than those of the new moon. For root-crops such as radishes, beetroots, carrots and kohlrabi the best results are also obtained by sowing 2 days before the full moon, contrary to the belief quoted above. The growth is more vigorous and the roots are juicier and sweeter to taste, whereas sowings before the new moon produce smaller, drier, more woody and bitter roots. Yield from a sowing before the full moon may be 50–60 per cent. higher than from that before the new moon.

The advantage of sowing 2 days before the full moon also holds good for flowering garden annuals. It is also strongly displayed in the case of maize, which, if sown on the day of the full moon, has a poorer and slower germination, less vigorous growth and a smaller yield than if sown 2 days earlier.

Kolisko points out that the lunar influence is not fully effective unless there is rain or artificial watering during the germination period, and quotes Rudolf Steiner that 'the forces of the moon are guided along the paths of the water'. Nevertheless, the stimulus once acquired remains decisive throughout the period of growth, flowering and fruiting.

Growth during a lunar phase: Kolisko studied the growth of wheat from sowings at fortnightly intervals throughout the year in a heated laboratory and found that, on the whole, growth is greater in the waxing phase (from new to full moon) than in the waning phase or from quarter to quarter. Similar behaviour was recorded when the effect of sunlight was excluded by growing wheat in complete darkness.

Depth of penetration of lunar radiation: Extensive experiments have been carried out for several years on the action of lunar radiation below the surface of the soil; the data are recorded in E. and L. Kolisko's 'Agriculture of To-morrow' (1946) which reviews cosmic influences in general. It is found that at 1 metre depth the effect of the moon on the growth of wheat is nearly identical with that at the surface; at 2 to 3 metres deep maximum growth is generally reached in a full moon period; between 5 and 16 metres the effect is progressively weaker, but is still shown by greater growth at the time of the Easter full moon.

Kolisko concludes that each year has a certain dominating lunar period and that the Easter full moon has a special significance for the whole year.

GROUP (*b*). OTHER INVESTIGATORS' WORK.

Moonlight: If the light of the moon affects living organisms it may do so by virtue of the intensity of illumination or because its light is plane-polarized at certain periods. The intensity of full moonlight is only 1/465,000 that of sunlight, and it is therefore highly improbable that so minute a value can produce a *greater* effect than sunlight. Wright (1927) points out that the light reflected from the new and the full moons is practically non-polarized; the maximum total amount of polarized light is received shortly after the 1st and before the 3rd quarters. A calculation by Fox (1932) reveals that very much more polarized light is incident on the earth during the daytime than on moonlight nights.

With polarized light equal in intensity to that of normal light, Macht (1926) produced an improvement in the height growth of seedlings of lupin, sunflower and cucumber. Semmens (1923) found remarkable increase in the hydrolysis of starch with diastase to dextrin and crystals of sugar when seeds of mustard, oats and wheat and potato were exposed to polarized light *in vitro*; these results were later confirmed in the living plant, but Esenbeck and Suessenguth (1930) were unable to produce the same effect and doubted its existence. Suessenguth (1930) did, however, obtain improvement in growth in length, though very slight, when exposing seedlings to polarized light of low intensity as in moonlight.

Whyte (1946) quotes several authorities who have shown that minimal intensities of light, and,

indeed, even of moonlight, can have a decisive influence on the course of *development* of plants, although they cannot have any significant effect on carbon dioxide assimilation. E.g. Gaertner and Braunroth (1935) grew long-day and short-day plants in two series: (*a*) exposed to normal moonlight and (*b*) with moonlight excluded, and found that moonlight acts like daylight, similarly on long- and short-day plants, and that it is strong enough to stimulate photoperiodic reactions; moonlight shortened by a few days the period before flowering in long-day plants and prolonged it in short-day plants.

It may be noted that the anthroposophists consider that the moon-forces can act in darkness and underground.

If lunar activity does affect living systems significantly it should be possible to find an electrical correlate. Burr (1944) obtained strong indication in a growing Maple tree of an electrical correlate of a diurnal rhythm, and also of a longer periodicity marked by wide potential differences. The peaks of electrical activity in the latter case seem to be more closely associated with the phases of the moon than with any other discernible factor. Burr's records of potential differences are, however, limited to a single set over three lunar months; his meteorological and other environmental factors were intermittent spot determinations.

Reproduction in plants: Periodicity in the production of sexual cells of the marine alga, *Dictyota dichotoma*, has been described by Williams (1905), Hoyt (1907) and Lewis (1910). At Bangor, Wales, the sexual products are liberated at *fortnightly* intervals, the rudiments of the sexual organs appearing a few tides before the neap, and the mature gametes being liberated 3–5 tides after the greatest spring tide; in October the time relations are reversed. At Plymouth the crops are later and mature more slowly than at Bangor, liberation occurring 7–12 tides after the greatest spring. At Naples initiation of the rudiments and liberation of the mature gametes occur at the same time, 2 or 3 days after the least neap tide. At Beaufort in North Carolina only *one* crop a month is produced, initiation occurring the day before, or the day of, and liberation occurring 6 days after, the greatest spring tide. Williams considers that the effective factor in producing periodicity is the increased illumination during the low water of spring tides. Hoyt dissents from this view as inconsistent with a monthly rhythm and the amount of illumination at Beaufort. Lewis considers the effective factor at Naples to be the stimulus of the maximum intensity of light and admits that it does not apply to other localities.

A few more cases of lunar periodicity in aquatic vegetation have been recorded; they indicate that when it exists it is specific and sometimes varies with locality.

Reproduction in animals: Lunar periodicity in reproduction has been proved to exist in some animals, e.g. sea urchins at Suez, which are sexually mature just before the full moon (Fox, 1924); and mayflies, which swarm round about the date of the full moon (Hora, 1929); and the Atlantic, Pacific, and Japanese Palolo, worms which swarm annually each at specific phases of the moon. Tides do not seem to be a causal factor (certainly not for mayflies) and the intensity of full moonlight seems to be too feeble. Moreover, even if the polarized light of the moon could cause a reproductive rhythm, this would be a bi-lunar not a lunar cycle (Fox, 1932).

In land animals the length of the breeding season of mammals and birds appears to depend in part on the daily number of hours during which the animals are exposed to light. Thus the moon may perhaps contribute to a lunar cycle in reproduction, not through its relatively small intensity of light as compared with that of the sun, but by the additional total number of hours of illumination per 24 hours at full moon over and above a threshold light value (Fox, 1932).

Menstruation in the human female has always been held to be related to the moon (Kolisko, 1946). But Gunn, Jenkin and Gunn (1937) from a statistical analysis of the data of over 10,000 menstruations of English women were unable to detect any connexion whatsoever between menstruation and the moon. This investigation disposed of the claim of Arrhenius (1898) to have found a tropical lunar monthly rhythm (27·32 days) in Swedish women; and that of DeLee (1933) for a synodical lunar rhythm (29·55 days). The well-known approximate coincidences are fortuitous.

Date of sowing: At meetings of the Société nationale d'horticulture de France in 1924, several horticulturists testified to the absence of lunar effects on sowings and seedling growth; earlier work of Arago, Flammarion and others in France between 1859 and 1909 was cited in confirmation (Meunissier, 1925). In experiments made by Becker (1939) in 1937 and 1938 at the State Botanical Institute, Munich, seeds of radish, cucumber, tomato and other garden crops were sown on days designated as favourable in the Moon Calendar of Lorenz and Bauer. Equally good crops were produced irrespective of whether the day of sowing was propitious or not.

Further experiments were made in the Munich Botanical Gardens in 1937–39 by Bergdolt and Spanner (1940) with sowings of radish, cucumber and tomato on astronomically important dates to test lunar and zodiacal influences. These gave no evidence of any appreciable positive or negative influence of the moon or the stars on plant growth.

Mather and Newell's experiments at the John Innes Horticultural Institution, Merton, in 1940 comprised sowings out of doors and indoors of radish, cabbage, dwarf bean, carrot, and onion four times during each lunar cycle, 2 days before the dates of each of the quarters of the moon. The plots were duplicated and randomized; the number of days between sowing and 50 per cent. germination was taken as a measure of speed of germination. The results were studied in graphs and as deviations from the moving average. In the outdoor sowings the speeds of germination were variable but showed no signs of being affected by any of the four quarters of the moon. The indoor germination speed was very constant except for the April full moon at which it was definitely accelerated. The authors conclude that temperature and moisture have profound effects but no consistent effect of the moon is observable. An attempt to combine good soil and weather conditions with possible advantages from lunar dates will merely result in a sacrifice of some of the proven advantages of the former.

In 1942, M. Mather made further glasshouse experiments at the John Innes Institution on the growth of seedlings of tomato and maize sown 2 days before each lunar phase over a period of 4 months. The speed of germination showed a tendency to a *weekly* rhythm so that the apparent effects of the full and the new moons were reversed for some successive periods. The rate of growth of the seedling was determined from the weight 33 days after sowing. The author concluded that (*a*) no phase of the moon regularly gives specially quick or specially slow germination, and (*b*) there is no consistency in the increase or decrease in weight from sowing at any given phase of the moon. On the other hand, sunlight and temperature produce significant effects on growth.

The only work on forest trees appears to be that of Rohmeder (1938) who carried out extensive series of replicated experiments with Spruce in 1935–37 at the forest seed-testing station at Munich. He obtained no evidence that the phases of the moon influence the germination of Spruce seed or the development of the seedling. The experiments were carefully designed and conducted and the data were statistically analysed. With an adequate number of repetitions all variations due to chance were evened out for each quarter phase. He concludes that, supposing there is any sort of lunar phase influence, its magnitude is so small that it is entirely suppressed by other growth conditions, especially temperature and moisture, and consequently is of no practical importance.

In India, numerous investigations have been made to find the best time for collecting seed of forest trees and these have not revealed definite variations in germinative capacity throughout the fruiting season. Yet depulped seeds of *Terminalia chebula* collected at weekly intervals for 3 months each year in 1940–43, and all sown on the same date, showed statistically significant variation in germination and indicated one particular fortnight (not a series of lunar fortnightly dates) as the best for practical purposes (Prasad, 1946).

Growth during a lunar phase: Classical authors and the Egyptian Fellahin of to-day assert that melons, marrows and other cucurbitaceous fruits grow most rapidly on moonlit nights. Fox (1922) measured fruit-lengths of marrow in Cairo daily for 3 months, during March to May, but found no differential rate of growth at different parts of the lunar month. He concludes that, as the lunar influence is supposed to show itself especially in these cucurbitaceous fruits, it may safely be assumed to be absent in all fruits.

In the Philippines, Gates (1923) observed that strong moonlight can affect the movement of leaflets of certain leguminous plants on warm clear nights in the dry season. This response is not produced at temperatures below 22° C. or in temperate regions.

Marcel (in Meunissier, 1925) observed that in the French Colonies the cocoa tree flushes 13 times a year, corresponding to a lunar phase, the flush being recognisable by the reddish tint of the young terminal leaves. This statement is not supported by published data.

Felling dates and durability of timber: In Europe it has been generally believed for centuries that timber felled at the time of the new moon or in its waning phase is more durable than that felled in other lunar phases. From 1669 until the Revolution, French law ordained that trees should be felled only under a waning moon. Among primitive peoples in the tropics and sub-tropics there are similar prejudices against the felling of trees and bamboos during the bright phases of the moon; these beliefs seem to be indigenous and not derived from contact with Europeans. They have in common the idea that the moisture-content of living wood decreases under the drying influence of the waning moon and therefore seasoning will be correspondingly quicker if the tree is cut near the date of the new moon.

In analysing these ideas it is necessary to evaluate separately (*a*) liability to borer attack, (*b*) liability to fungus attack and (*c*) variation in intrinsic resistance to each.

There have been many carefully controlled investigations of the influence of the *season* of felling on durability but very few that compare the effect of phases within a lunar cycle. One of the earliest of the latter was made by Duhamel du Monceau (1764) in 1732–35 in France with Oak felled at the middle of the waxing and the waning phases; he obtained better results from the waxing phase and concluded that the popular belief was wrong.

Moisture-content and fungus attack: Moisture-content is the most important physical condition influencing the rate of decay of wood. Density has only a minor effect on resistance to decay. It is known by systematic experiment that the water-content of living sapwood varies seasonally in some species of trees and is more or less constant throughout the year in others; e.g. Canadian Birches and Aspen and *Tsuga canadensis* show a marked seasonal rhythm, whereas Pine, Spruce and Balsam Fir, in the same region show little seasonal change (Gibbs, 1939). Variation within the lunar cycle does not appear to have been studied in trees except with inconclusive results like those of Nördlinger in Germany (1890). The moisture-content of solid culms of *Dendrocalamus strictus* was determined by Beeson and Bhatia (1936) in north India from Bamboos felled at fortnightly intervals over 17 months in 1930–31. A regular lunar rhythm of sap increasing from the full to the new moon and decreasing from the new to the full moon was apparent, but there was no marked seasonal variation. These results are contrary to the popular belief that sap is most abundant in woody tissues when the moon is full.

Typical of the exact knowledge of the proper season for felling is the work of Knuchel and Gäumann (1930), who felled Norway Spruce and Silver Fir in Switzerland monthly in the same phase of the moon and at the same hours of the day over a 12-month period in 1926–27. These experiments were designed to exclude any lunar effect and they showed that the season of felling has no substantial influence on the specific gravity, moisture-content, shrinkage, resin-content or working qualities but that it strongly influences the rate of seasoning. Fellings in October–January dried slowly and evenly, taking 6 to 8 months to become air-dry; fellings in May–July were air-dry in 1 or 2 months and thus rapidly overtook the earlier winter fellings. Gäumann's results showed a definite correlation between the time of felling and the inherent resistance to decay of green unseasoned wood; September–January fellings were resistant, August and February fellings were much less resistant, and May and June fellings showed most fungous decay and splitting. For Beech, however, Gäumann (1938) did not find any significant difference in rot resistance of wood felled at different seasons. These Swiss experiments show that the effect of the season of felling on the rate of drying and the effect of weather on the activity of decay organisms dominate any effect that may be due to the phase of the moon.

Borers: As regards the degree of damage by boring insects, investigations have almost all been made on a seasonal (not lunar phase) basis of comparison. The liability of felled trees to attack, i.e. to oviposition, depends on the one hand on the dates of the emergence-period and longevity of the adult insect, and, on the other hand, on the amount of drying-out of bark and sapwood, or the amount of depletion of starch. In temperate climates and with borers having annual life-cycles the safety-period for felling is longer than in the tropics and with borers having several overlapping broods per annum. Safety- or low-risk periods have been determined for numerous species of borers, and fellings within these periods can safely ignore the phase of the moon. In the case of trees the bark of which will remain alive for many months, any predisposition to attack inherent in the date of felling can be modified by the logging procedure, and especially by postponing the lopping of branches and the removal of the crown (Beeson, 1941). The degree of damage by *Dinoderus* attack on Bamboos in India is determined, not by the date of felling in relation to the phase of the moon, but by the amount of starch present in the felled culm; the starch-content of the living culm varies seasonally and not according to the lunar phase (Beeson and Bhatia, 1936; Gardner, 1945). Felled trees in the Old and New World tropics are exposed for most of the year to attack by complexes of borer species, each of which needs slightly different conditions for oviposition and feeding. It is, therefore, not surprising that experiments to test the universal protection assigned to lunar influence have given negative results. Those made in Trinidad (1935) on *Mora excelsa* found no connexion between the amount of damage and the phase date of felling.

Yield of gum, resin, latex, etc.: Similar beliefs in the influence of the moon on the production of gum, resin, latex, tannin, etc., prevail in many parts of the world; in general, the tree is considered to contain least of the substance during the new moon period and most at the full moon.

The yield of resin from Pines and of syrup from Sugar Maples has been investigated from numerous aspects over many years without the recognition of any lunar influence; on the contrary, variations in yield are explained in terms of tapping systems, genetic factors, weather and environmental conditions. Seasonal changes in quality and quantity have been demonstrated for many forest products of this nature. For example, variation in the tannin-content of leaves of *Rhus* spp. in U.S.A. is seasonal and is also influenced by soil conditions, genetic factors and the cutting rotation (Sievers and Clarke, 1944); changes in the gutta-content of the root of *Euonymus verrucosus* in U.S.S.R. are closely connected with the seasonal development of the plant. The resin-content varies in inverse proportion to the gutta-content (Yurkevich, 1944). The highest tannin-content of myrobalan (*Terminalia chebula*) is found in seeds collected in January anywhere in India; this period is also that of optimal germination capacity (Prasad, 1946).

Ferrand's work (1941) on *Hevea brasiliensis* in the Belgian Congo revealed that the daily concentration of latex *in situ* varies according to meteorological conditions. Dark nights, overcast days, persistent cold and fog increase the concentration of latex; high air temperature and strong luminosity diminish the concentration. Within the individual tree the local concentration at different aspects of the trunk varies in accordance with the amount of exposure to sunlight or shade received by the crown directly above the tapping-point.

Summary

Beliefs that the phases of the moon affect the rate of development of plants are worldwide; among primitive peoples, sowing and harvesting are often regulated by the lunar calendar. The only experimental evidence in favour of such lunar influence is that published by L. Kolisko, who claims improved germination, growth, quality and yield for crops sown on certain lunar dates; and the observations of various authorities that moonlight acts like minimal intensities of daylight on the course of development of plants. All other investigators in many parts of the world have been unable to discover any consistent correlation between the phases of the moon and the vital processes of land plants. If any lunar effect does exist, it is not revealed by statistical analysis and must be too small to be of value in agricultural and forestry practice.

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ABSTRACT SECTION

NOTE.—A capital letter in square brackets following the reference denotes the language in which the paper is written. A small letter denotes a summary in another or the same language, e.g. [G.e.]—German, with English summary. English [E.] is only indicated for papers published in journals usually written in foreign languages.

The term "billion" used in papers originating in North America means a thousand million.

0. GENERAL FORESTRY

01. NOMENCLATURE. BIBLIOGRAPHY. MATHEMATICAL AND STATISTICAL ANALYSIS

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The Forestry Commission in 1934 issued a list of botanical names of the more important forest trees, with an instruction that these names were to be adhered to in all future departmental records and official publications. It is not proposed to alter the Forestry Commission standard botanical names, and these will continue to be used by all officers as heretofore. The list is here reproduced together with the English name and the latest name according to the International Rules of Nomenclature where this differs from the Commission's nomenclature.

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02. DICTIONARIES

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[826]. 02.4. GARCIA-PIQUERA, C. **A Spanish-English glossary of forestry terminology, I.** *Carib. For.* 7 (2), 1946 (103–20). [Tropical Forest Exp. Sta., Puerto Rico.]

[827]. 02.4 : 12.2. RUSSELL, P. G. **Spanish-English glossary of botanical terms.** Office of Foreign Agricultural Relations, U.S. Department of Agriculture. 1944. pp. 13.

05. PERIODICALS

05.3. *Annual Reports*

[828]. 05.3 (410). GREAT BRITAIN. **Imperial Agricultural Bureaux: sixteenth annual report of the Executive Council, 1944–45.** H.M. Stationery Office, London. 1946. pp. 28.

[829]. 05.3 (410). GREAT BRITAIN. **Twenty-first annual report of the Imperial Forestry Institute: academic year, 1944–45.** University of Oxford. 1946. pp. 16.

[830]. 05.3 (410). GREAT BRITAIN. **Imperial Institute: annual report, 1945.** Imperial Institute, London. [1946.] pp. 74.

[831]. 05.3 (54.2). UNITED PROVINCES. **Annual progress report of Forest Administration in the United Provinces for the year 1944–45.** Superintendent, Printing and Stationery, Allahabad. 1946. pp. 21 + xxvi.

[832]. 05.3 (54.87). CEYLON. **Silvicultural research: Ceylon: 1944.** Office of the Conservator of Forests, Colombo, Ceylon. 1946. pp. 16.

[833]. 05.3 (67.6). KENYA. **Forest Department annual report for the year 1944.** Govt. Printer, Nairobi. 1946. pp. 13.

[834]. 05.3 (67.6). UGANDA. **Annual report of the Forest Department for the year ended 31st December, 1945.** Govt. Printer, Entebbe. 1946. pp. 17.

[835]. 05.3 (68.1). BECHUANALAND. **Annual report of the Forest Officer for the Bechuanaland Protectorate for the year ending 31st December, 1945.** [Forest Department, Bechuanaland.] 1946. pp. 3.

[836]. 05.3 (69). SEYCHELLES. **Abbreviated annual report of the Department of Agriculture for the year 1944.** Govt. Printing Office, Mahé. 1945. pp. 7.

[837]. 05.3 (71.1). BRITISH COLUMBIA. **Report of the Forest Service: year ended December 31st, 1945.** King's Printer, Victoria, B.C. 1946. pp. 90 + plate.

[838]. 05.3 (71.21). MANITOBA. **Annual report of the Forest Service, 1944–45.** Department of Mines and Natural Resources. [1946.] pp. 32.

[839]. 05.3 (71.5). NEW BRUNSWICK. **109th annual report of the Department of Lands and Mines of the Province of New Brunswick for the year ended 31st October, 1945.** Fredericton, N.B. 1946. pp. 142 + plates.

[840]. 05.3 (71.6). NOVA SCOTIA. **Report of the Department of Lands and Forests, 1945.** King's Printer, Halifax. 1946. pp. 118.

[841]. 05.3 (729.7). TRINIDAD. **Report of the Governing Body, the Principal's report for 1945 and the accounts for the year ended August 31st, 1945.** The Imperial College of Tropical Agriculture, St. Augustine, Trinidad. 1946. pp. 31.

[842]. 05.3 (946). TASMANIA. **Report of the Forestry Department for the year ended 30th June, 1944.** Govt. Printer, Hobart. 1944. pp. 8.

06. SOCIETIES. ASSOCIATIONS

[843]. 06.1 (73). HOSMER, R. S. **The Society of American Foresters: notes on its progress 1941–1945.** *J. For.* 44 (6), 1946 (426–31).

[844]. 06.1 : 06.2. Die Rolle des C.I.S. bei internationalen Forstkongressen. **[The rôle of the Centre International de Sylviculture at international forestry congresses.]** *Intersylva* 1, 1940–1 (86–122). [G.e.f.it.span.] [With bibliography of the papers read at the 1st and 2nd International Forestry Congresses at Rome, 1926, and Budapest, 1936.]

07. EDUCATION AND RESEARCH

[845]. 07.1 (47.0) : 81. JURIN, B. Die Ausbildung des höheren Forstpersonals in der Sowjetunion. (Zustand 1941.) **[The training of the higher forest staff in the Soviet Union. (Status of 1941).]** *Schweiz. Z. Forstw.* 97 (7), 1946 (319–22). [G.]

[846]. 07.1 (71) : 66. MULLOY, G. A. **Forest education.** *For. Chron.* 22 (2), 1946 (110–2). [Dominion Forest Service, Ottawa.]

The writer's principal criticism of existing forestry education is that, while students are fully instructed in mensuration, they are given little instruction on the business principles involved in running a forest, and that little usually at the end of their course. He urges that if a student has been given a good grounding in business methods and principles, he will then be in a position to study mensuration with much more ease and benefit.

[847]. 07.1 (71) : 91.8. WILSON, J. O. **Educational training for jobs in connection with forests and forest industries.** *For. Chron.* 22 (2), 1946 (120–7).

There are at present four schools at Canadian Universities teaching forestry and forest engineering, but the number of men graduating is inadequate to the need for trained foresters. A new set of courses is required to meet the need for trained logging engineers. Facilities should be provided for training research workers, and there should be adequate funds for research work, so that these men may be employed when they are trained. Schools are needed in rural areas, within easy reach of forest operations, where the elements of forestry and vocational training in all kinds of forest

operations can be taught. Many Ranger Schools are needed. *From author's summary.*

[848]. 07.2 (494) : 11.14.46. HAEFELI, R. Die Arbeiten der Station Weissfluhjoch der Schweizerischen Schnee- und Lawinenforschungskommission 1934–1940. [**The work of the Weissfluhjoch Station of the Swiss Commission for the Investigation of Snow and Avalanches, 1934–40.**] *Intersylva* 1, 1940–1 (165–86). [G.e.f.it.span.]

[849]. 07.2 (71). ROBERTSON, W. M. **Summary of research work contemplated by Dominion Forest Service for 1946.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 843 (F-1), 1946. p. [1]. Also in *Pulp Paper Mag. Can.* 47 (6), 1946 (100).

09.1. *Forest History*

[850]. 09.1 (44). BUFFAULT, P. Pour servir à l'histoire de la forêt de Mormal. [**Notes for the history of the forest of Mormal.**] *Rev. Eaux For.* 82 (7), 1944 (383–99). [F.]

Notes on the management of the forest, transcribed from archives of the 15–17th centuries.

[851]. 09.1 (44) : 92. GÉNEAU, G. La législation forestière sous l'ancien régime: les ordonnances du XIV^e siècle et du début du XVI^e. [**Forest legislation before the Revolution: ordinances of the 14th century and beginning of the 16th.**] *Rev. Eaux For.* 78 (4–6), 1940 (248–63); 79 (1; 10; 11; 12), 1941 (27–40; 736–51; 822–35; 888–98). [F.]

[852]. 09.1 (44) : 92. GÉNEAU, G. La législation forestière sous l'ancien régime: l'ordonnance de 1669. [**Forest legislation before the Revolution: the ordinance of 1669.**] *Rev. Eaux For.* 80 (3; 5; 7; 11), 1942 (157–168; 257–269; 344–358; 512–520). [F.]

[853]. 09.1 (44) : 92. GRANGER, A. Essai sur la législation forestière de 1789 à 1827. [**Essay on forest legislation from 1789 to 1827.**] *Rev. Eaux For.* 81 (9), 1943 (453–70). [F.]

[854]. 09.1 (44) : 92. GRANGER, A. L'application et les effets de l'ordonnance des eaux et forêts de 1669. [**The application and effects of the Waters and Forests Ordinance of 1669.**] *Rev. Eaux For.* 81 (10), 1943 (536–49). [F.]

[855]. 09.1 (494) : 90. BLUMER, E. Geschichtliche Entwicklung und heutiger Stand der Waldwirtschaft im Glarnerland. [**Historical development and present state of forestry in the Canton of Glarus.**] *Schweiz. Z. Forstw.* 97 (7; 8/9), 1946 (276–84; 333–46). [G.f.]

09.2. *Pre-history. Pollen Analyses, etc.*

[856]. 09.2(44). DUBOIS, G., and DUBOIS, C. Histoire forestière flandrienne comparée de la Montagne de la Madeleine, des Bois Noirs et des Monts du Forez. [**Comparative forest history of the Montagne de la Madeleine, the Bois Noirs, and Monts du Forez.**] *C.R. Acad. Sci., Paris* 220 (15), 1945 (534–5). [F.] D.S.I.R.

The forest cover of these three massifs, from the boreal age to the present day, as revealed by pollen analysis, has developed along the classic lines of the moderately high mountains of France. Beech was usually dominant in the Beech/Silver Fir type. The Fir appeared in the course of the sub-boreal and sub-atlantic periods, sometimes gradually, sometimes suddenly so as to attain local dominance, but its appearance was not regulated by any apparent rule of altitude, latitude or aspect. *From authors' summary.*

[857]. 09.2 (44). DUBOIS, G. Connaissance actuelle de l'histoire du peuplement forestier des montagnes françaises. [**Present knowledge of the history of the forest stands of the French mountains.**] *Rev. Géogr. alp.* 34 (1), 1946 (57–68). [F.] *Abstr.* in *Rev. Eaux For.* 84 (5), 1946 (277).

The author presents the results of analyses of peat bogs in mountains and high plateaux of France, from which he deduces the forest succession back to the year 10,000 B.C. In the Savoy Alps at some time during the period 4,000–3,000 B.C., the mixed Oak forest was suddenly replaced by almost pure Fir, which in turn gave place very suddenly, a little before the Christian era, to almost pure Spruce.

[858]. 09.2 (481). FÆGRI, K. **A pollen diagram from the sub-Alpine region of central South Norway.** *Norsk geol. Tidsskr.* 25, 1945 (99–126 + dgm.) [E.] L.S.

[859]. 09.2 (54.6) : 12.26–8. PURI, G. S. **Some fossil leaves of the Ulmaceae from**

the Karewa deposits of Kashmir. *J. Indian bot. Soc.* 24 (4), 1945 (183–90 + plates). [Lucknow Univ.] O.B.D.

The modern *Ulmus wallichiana, U. laevigata* and *U. campestris* occur in the lower Pleistocene of Kashmir with a fourth undescribed species.

[860]. 09.2 (54.6) : 12.26–8. PURI, G. S. **The genus *Quercus* in the Karewa deposits of Kashmir, with remarks on the Oak forests of the Kashmir Valley during the Pleistocene.** *Proc. Indian Acad. Sci.* 22B (4), 1945 (232–56 + plates). L.S.

The genus *Quercus* is represented in the Karewa flora by the species *dilatata, semecarpifolia, ilex, incana* and *glauca*. The Oaks, which must have been dominant trees in the flora of the Kashmir Valley during the Pleistocene, do not now occur there or on the mountain slopes flanking it to the south-west, although *semecarpifolia, dilatata*, and *incana*, are now common in the outer ranges of the western temperate Himalayas. *Quercus ilex* is confined to the inner dry ranges of the Himalayas, whereas *Q. glauca* occurs in the outer ranges at lower elevations. The Pleistocene climate and vegetation of the Kashmir valley are discussed.

[861]. 09.2 (78.6). WILSON, L. R., and WEBSTER, R. M. **Plant microfossils from a Fort Union coal of Montana.** *Amer. J. Bot.* 33 (4), 1946 (271–8). O.B.D.

Fossil spores and pollen of 17 species (including *Picea, Sequoia, Taxodium, Alnus, Betula, Carya* and *Quercus*) from a Palaeocene coal mine in Montana are described. The plant microfossils consisted mainly of ferns (51.5 per cent.) *Momipites* (32·2 per cent.), *Carya* (6·3 per cent.) and *Taxodium* (5·6 per cent.).

[862]. 09.2 (99) : 12.25. COOKSON, I. C. **Pollen-analysis of lignite from the Kerguelen Archipelago.** *Nature, Lond.* 157 (3994), 1946 (658). [Botany Department, Univ. of Melbourne.]

Examination of a sample of lignite from Port Jeanne D'Arc has revealed the presence of numerous spores and pollen grains, among which winged pollens of podocarpaceous affinities appear to predominate. Pteridophyte spores are rather numerous, but angiospermous pollens appear to be infrequent. Some large wingless grains comparable with araucarian pollens have also been observed.

[863]. 09.2 : 12.25. LOUBIÈRE, A. Répartition statigraphique [*sic*] des bois à structure cupressiforme. **[Geological succession of woods with cupressiform structure.]** *Bull. Mus. Hist. nat., Paris* (*2e Sér.*) 15 (4), 1943 (256–7). [F.] L.S.

A list of species of *Cupressinoxylon* occurring in the Permian, Jurassic, Cretaceous and Tertiary.

[864]. 09.2 : 12.25. SELLING, O. H. **On Cupressoid root remains of Mesozoic age from the Arctic.** *Ark. Bot.* 31A (4) (*Art.* No. 13), 1944. pp. 20 + plates. [E.] O.B.D.

Protojuniperoxylon arcticum n. sp. from Hope Island, Svalbard (76° 30′ N., 21°–22° E.).

09.4. *Forest Statistics*

[865]. 09.4. DORE, V. Die Arbeit des Internationalen Landwirtschaftsinstitutes an der Vervollkommnung der Forststatistik. **[The work of the International Institute of Agriculture towards the perfecting of forestry statistics.]** *Intersylva* 1, 1940–1 (434–46). [G.e.f.it.span.]

[866]. 09.4 (485) : 09.7 : 33. STREYFFERT, T. Die Nutzung der Wälder Schwedens. **[Swedish forests and their utilization.]** *Intersylva* 1, 1940–1 (58–71). [G.e.f.it.span.]

[867]. 09.4 (489) : 35 : 98. ANDERSEN, M. Dänemarks Holzbilanz. **[Denmark's timber balance.]** *Intersylva* 1, 1940–1 (187–205). [G.e.f.it.span.]

[868]. 09.4 (75 : 76). MESAVAGE, C., and DUERR, W. A. **Timber resources of the Lower South.** *Sth. Lumberm.* 172 (2164), 1946 (38–9).

A reconnaissance of timber resources in 8 Southern states of the United States puts the volume of sawtimber on 1st January, 1946, at 220 billion bd. ft., a decrease of 14 per cent. in bd. ft. volume since the initial survey in 1935. Total growing stock stands at about 78 billion cu. ft., a decrease of less than 1 per cent. in cu. ft. volume in the decade. The total growing stock of Pines fell by 4 per cent., and that of hardwoods rose by 5 per cent.

[869]. 09.4 (75.7) : 35. LOTTI, T., and TODD, A. S. **South Carolina forest growth and drain, 1936–43: a Forest Survey progress report.** *For. Surv. Release Appal. For. Exp. Sta.* No. 20, 1945. pp. 42.

09.7. *Monographs of Individual Forest Regions*

[870]. 09.7 (213). GONGGRYP, J. W. Die Stellung der Forstwirtschaft in den Tropen. [**The position of forestry in the tropics.**] *Intersylva* 1, 1940–1 (324–43). [G.e.f.it.span.]

[871]. 09.7 (42.1–8) : 09.1. HART, C. E. **The Royal Forest of Dean.** *Wood* 11 (6), 1946 (174–7).

[872]. 09.7 (47.8) : 12.19.2. KHUDYAKOV, I. I. Saltovski les (Nizhnee Zavolzhe). [**The Saltovo forest (Lower Transvolga region).**] *Bot. Zh. SSSR* 30 (6), 1945 (279–80). [Russ.e.] [Saratovski Gosudarstvenny Univ.] O.B.D.

A relict forest of Birch, Oak, Alder, Elm, Poplar and Tartar Maple, covering 5,731 ha. in a semi-desert region in the Volga basin.

[873]. 09.7 (492) : 23.21 : 23.51. FOVERNIED, D. Les richesses forestières des Pays-bas. [**The forest resources of the Netherlands.**] *Rev. int. Bois.* 13 (106), 1946 (89–92). [F.]

The total forest area of the Netherlands is 258,482 ha., or 7·8 per cent. of the total area of the country. It comprises:—

Oak coppice	35,008 ha.	14 per cent.
Other coppice	24,333 „	9 „
Broadleaved high forest	22,455 „	9 „
Conifers	165,717 „	64 „
Willows	10,969 „	4 „

Pine has been the species most used in afforestation, usually in mixture with *Quercus rubra*, *Q. pedunculata*, and *Fagus sylvatica*, and sometimes *Castanea sativa*, for purposes of soil improvement. The understorey was generally established in 50- to 70-year-old stands by sowing in lines. Climatic and edaphic conditions are, however, unfavourable to the decomposition of Oak and Beech litter, and the growth of the main stand was also often unfavourably affected by the growth of the understorey. Experiments have now shown that the establishment of an understorey of *Sorbus aucuparia*, *Acer campestris*, *Rhamnus frangula*, and other species belonging to the *Querceto-Betuletum* association is much more satisfactory. Remarkably good results have been obtained from the use of *Prunus serotina* as an auxiliary species and soil improver. Scots Pine is being increasingly replaced by Green Douglas Fir, Japanese Larch and *Larix decidua* var. *sudetica*. Douglas Fir does very well, except on the coast, where it is injured by wind. The variety *viridis* is much more successful than the varieties *caesia* and *glauca*, which are more susceptible to disease. *Pinus nigra* var. *austriaca*, and var. *calabrica* are much used for planting on littoral sand dunes, the former in the more exposed and the latter in the more sheltered sites.

Poplar is extensively grown: in 1940 there were about 2 million trees with an annual yield of 100,000–200,000 cu.m. of wood. The species most generally planted, *Populus serotina*, *P. deltoides* var. *missouriensis*, and *P. marilandica*, are grown on a 25-year rotation. The wood is used for the manufacture of matches, sabots and plywood veneer.

[874]. 09.7 (52) : 3. ZUMWALT, E. V. **What forests mean to Japan.** *Amer. For.* 52 (5), 1946 (204–7, 245–6).

Land classified as forest covers about 59 million acres, or 63 per cent. of the total land area of Japan. About 7 million acres of this consists of scrub forest or brushwood. The total volume of standing timber is estimated by Japanese foresters to be about 67 billion cu. ft., of which 32 billion ft. are softwoods and 35 billion ft. hardwoods. The estimated annual growth of timber and pulpwood stands is 685 million cu. ft. Direct food supplies from the forest lands include wild game, nuts, fruit, mushrooms and bamboo sprouts. From September to November 1945 it was estimated that over a million metric tons of acorns would be collected to be used for the manufacture of flour. Over 80 per cent. of this would be ground by primitive means, the rest would be converted in modern mills. The National Forest Act of 1907, amended in 1911, provides for reservation of protection forests to prevent erosion, maintain stream flow, etc., and about 10 per cent. of the total forest area has been set aside for that purpose and is under the control of the Bureau of Forestry. Logging methods are mostly primitive but utilization in the woods is very close. Stumps are very low; logs are cut in 10- to 12-ft. lengths down to a 3- or 4-in. top; branches are bundled for firewood or made into charcoal. The bark of *Cryptomeria* is peeled, bundled, and sold for roofing material. It is claimed that a roof of this material will last for 15 years. There are some 7,500 sawmills, mostly driven by hydro-electric power, about three-quarters of them rated at less than

30 h.p. The combined mill capacity is over 3 billion bd. ft. per year. Here, too, utilization is very close and small mills saw up logs as small as 4 in. in diameter and 6 ft. long. Charcoal, which is the principal source of domestic fuel, and during the war was much used as producer-gas fuel, is made in the woods in small kilns or pits. About half of the production is manufactured the year round; the other half from November to March. This provides employment for the rural population at a time when there is little for them to do on the farms.

[875]. 09.7 (65) : 91 : 23.1 : 34. THOMSON, A. P. **Some Mediterranean forests. I. The Forest of Bugeaud.** *N.Z. J. For.* 5 (2), 1945 (86–90).

After the Forest of Bougeaud in Algeria was created a National Park in 1931, exploitation for sawtimber ceased; harvesting of cork and other minor forest products continued. Cork Oak occurs in pure stands on the higher ridges, associated with *Erica arborea*, *E. scoparia*, *Arbutus unedo* and other shrubs. Chêne Zeen (*Quercus mirbeckii*) occurs on the moister northern and eastern slopes, usually pure but sometimes mixed with Cork Oak. *Pinus pinaster*, which occurs in small stands, is at the extreme southern limit of its range.

A Forestry Company operated here in the war and removed 800,000 bd. ft., more than half of which was *Q. mirbeckii*. Owing to the limited diameter capacity of the portable sawmills, logs over 21 in. d.b.h. could not be handled and the residual stand of mature Oak trees has not developed a canopy. Regeneration will be difficult, as good seed years are infrequent and the slopes are so steep and the winter rains so heavy that almost the whole acorn crop would be washed down into the Cork Oak and Pine belts below. The solution envisaged by the French foresters is as follows: (1) To graze heavily for 5–6 years, thus keeping down development of undergrowth. (2) Then to restrict domestic grazing and exterminate the wild boar. (3) To dig contour trenches at intervals of 20 ft. to impede the downward flow of water-borne acorns. The plan would have to be geared to a seed year; its operation is complicated by the fact that the periodicity is not known.

Utilization of minor forest products is highly developed. With the exception of some inedible fungi, all the plant growth appeared to be utilized. Products include pitprops and sleepers from thinnings, fuel from lop and top and pine cones, charcoal, pipe blocks from roots of *Erica arborea*, *Arbutus* berries for jam-making, edible fungi, brush from heaths and brooms for frost-prevention fires in vineyards, acorns for domestic pig feed.

[876]. 09.7 (71.8) : 6. MCCRAW, W. E. **Forests and forest management in Newfoundland.** *Pulp Paper Mag. Can.* 47 (5), 1946 (90, 92).

It is estimated that 24,500 sq. miles of Newfoundland are capable of forest growth. The forest species in order of importance are: in Eastern and Central Newfoundland—Balsam Fir, Black Spruce, White Spruce, Larch, White Pine, White Birch, Aspen, Poplar; in Western Newfoundland—Balsam Fir, Black Spruce, White Spruce, Larch, White Pine, Aspen, Poplar, Yellow Birch. Two large pulp and paper companies control 19,000 sq. miles of forest limits. The fishermen's limits, which extend 3 miles in from the coast practically all round the island and are reserved to them for fuel and timber for fishing purposes, are not adequately protected from fire or overcutting.

The Government of Newfoundland has never accepted the function of forest management, with the exception of preventing the pulp and paper industries from buying pulpwood cut on the fishermen's limits. Forest protection, regulation and the degree of utilization, have been the responsibility of the limit-holders, and this has caused the paper industries to take the lead in these matters. Each of the paper companies has a system of forest protection on its individual limits, and they combine with the Government to form the Newfoundland Forest Protection Association to patrol the right of way of the Newfoundland Government Railway, and public highways running through their limits. The forest fire hazard as determined by the Wright System for 96 days from 1st June to 21st September, 1945, was as follows:—

Hazard	*No. of days*	*Per cent.*
Extreme	18	18·8
High	17	17·7
Moderate	21	22·0
Low	40	41·5

A forest insect survey has been carried out by the paper companies each summer since 1934.

Practically all economically important forest insects have been taken in the sampling, but none has yet reached epidemic proportions. Silvicultural research has been done in two main fields: study of regeneration of coniferous species following fire and cutting operations, and cutting methods to increase the proportion of Spruce and decrease the period between successive cuts.

[877]. 09.7 (932–9 : 96.1–8 : 95). SPARHAWK, W. N. **Notes on forests and trees of the central and southwest Pacific area.** U.S. Forest Service. [1945?] pp. 78.

Brief descriptions are given of the forests of the various island groups, and notes on tree species which appear, from available information, to be of sufficient size, abundance and wood properties to make them worth cutting.

1. FUNDAMENTAL NATURAL LAWS OF THE FOREST

11.1. *Atmosphere*

11.16. Electricity. [Radiation]

[878]. 11.16.1 : 12.11. FEHÉR, D. Untersuchungen über die biologische Wirkung der kurzwelligen Strahlung der Elemente. II–V. **[Investigations on the biological effect of the short-wave radiation of chemical elements. II-V.** [With summary of I.]] Untersuchungen über die biologische Wirkung der durchdringenden Strahlung der Elemente. VI–VII. **[Investigations on the biological effect of the penetrating radiation of elements. VI-VII.]** *Erdész. Kisérl.* 45 (1/4), 1943–4 (341–68). [G.hu.e.g.]

In Parts I–VII it has been shown that 72 of the elements, including 68 which have previously been regarded as non-radioactive, develop a biologically effective, penetrating, presumably short-wave radiation which, as efforts towards its more exact determination by traditional physical methods have so far been unsuccessful, can be measured quantitatively only by means of a physiological excitation technique devised by the author. The radiation causes tropic responses, stimulates assimilation and growth, and hastens flowering, but the inner mechanism of the physiological effects is not yet understood. *From author's summaries.*

11.4. *Soil*

See also *For. Abstr.* 8 (Nos. 1497–8).

[879]. 11.4 : 01.6. **Bibliography of soil science, fertilizers and general agronomy, 1937–40.** Imperial Bureau of Soil Science, Harpenden, England. 1941. pp. xxiii + 504. Price 25*s*. **Bibliography of soil science, fertilizers and general agronomy, 1940–44.** Imperial Bureau of Soil Science, Harpenden, England. 1946. pp. 567. Price 30*s*.

A bibliography, the first volume of which serves as a cumulative index to Vols. I to III and the second to Vols. IV to VII of the abstract Journal *Soils and Fertilizers.*

[880]. 11.4 : 23.2 : 24. WILDE, S. A. **Forest soils and forest growth.** Chronica Botanica Co., Waltham, Mass. Wm. Dawson and Sons, Ltd., London, W.1. 1946. pp. xxii + 241. Price $5.00.

The subject is dealt with on somewhat broad and unconventional lines without bias in the direction of pedology or of silviculture. Forest soils are interpreted as carriers of definite floristic associations, as media for the growth of nursery stock or forest plantations and as dynamic systems that react to different forms of silvicultural treatment. A fair balance is maintained between the theoretical foundations and the practical aspects of the utilization of land under forests. Twenty chapters deal with: historical aspects; genesis of forest soils; genetic soil groups of the world with a classification and characteristics of upland, hydromorphic and embryonic soils; the biological structure of forest cover and its relation to environment; physical and chemical properties; soil organisms and their control, and forest humus; soil-forest types and soil surveys; tree planting; amelioration measures; silvicultural cuttings and determination of yield in relation to soil productivity; and, with special reference to forest nurseries, the practice of irrigation, use of fertilizers, lime, composts and green manure in the adjustment of soil fertility. There are numerous original text figures and tabulated statements, 7 plates, a copious up-to-date bibliography and good indexes.

11.41. Soil Physics

[881]. 11.41.3 : 11.48.5 : 21.2. LOCKET, G. H. **A preliminary investigation of the availability to plants of the water in chalk.** *J. Ecol.* 33 (2), 1946 (222–9).

In the course of observations of the colonization of bare chalk at Harefield, Middlesex [see *For. Abstr.* 8 (No. 944)], it became clear that the rate at which plants could obtain water was an especially important factor. An account is given of the methods employed for measuring the amount of water in the chalk available to plants. It was found that the water in pulverized chalk is much more readily available to plants up to a suction pressure of 1 atm. than that in the solid chalk (which parts with very little water up to this pressure). Some species adapt their root systems on chalk to exploit this more available water.

Drought conditions prevail in chalk when the suction pressure is about *p*F 2·7–2·8 (500–600 cm. of water). The large amount of water available between *p*F 3·0 (1 atm.) and 4·2 (the wilting point) may well keep alive those plants which are able to exploit it, but they cannot 'flourish' on it, in the sense of increasing vegetatively. [Cf. also *For. Abstr.* 8 (No. 1381).]

11.43. Biology of Soil, including Mycorrhiza

[882]. 11.43. STÖCKLI, A. Der Boden als Heimstätte des Lebens. **[The soil as a habitat.]** *Schweiz. Z. Forstw.* 97 (8/9), 1946 (356–78). [G.f.g.]

A concise illustrated review (16 refs.) of the chief relations between the soil fauna and flora and their habitat. Stöckli proposes two indices of population density: (*a*) *Wohndichte* = volume of living substance per unit volume of habitat; (*b*) *Besiedelungsdichte* = number of organisms per unit volume of habitat. Particular attention is given to the habitat limitations imposed in many cases by the availability of suitable interstices in the soil; to the role of organisms in decomposition and soil formation, and the importance in this respect of a mixed flora and fauna of diverse habits; and to the role of organisms in modifying the physical structure of the soil.

[883]. 11.43 (65 : 66.1 : 66.2) : 09.7. FEHÉR, D. Der Wüstenboden als Lebensraum. Bericht der französisch-ungarischen Sahara-Expedition im Jahre 1936. **[Desert soil as a habitat. Report of the Franco-Hungarian Sahara Expedition, 1936.]** *Erdész. Kisérl.* 45 (1/4), 1943–4 (213–340 + plates). [G.f.]

A condensed account in German of the results published in full by Killian, C., Fehér, D., and Frank under the title 'Recherches sur la microbiologie des sols désertiques' (P. Lechevalier, Paris, 1939).

[884]. 11.43.1 : 01.6. KELLEY, A. P. **Additions to the literature of mycorrhizae.** *Suppl.* No. 8 to *The Literature of Mycorrhizae*, Landenberg, Pa. 1945. pp. 17.

A current bibliography with abstracts. [Cf. *For. Abstr.* 6 (72).]

[885]. 11.43.1 : 12.25 : 11.47.1. MCCOMB, A. L., and GRIFFITH, J. E. **Growth stimulation and phosphorus absorption of mycorrhizal and non-mycorrhizal Northern White Pine and Douglas Fir seedlings in relation to fertilizer treatment.** *Plant Physiol.* 21 (1), 1946 (11–7). [Iowa State College, Ames, Iowa.] O.B.D.

Two-year-old seedlings of Northern White Pine [*Pinus strobus*] and Douglas Fir [*Pseudotsuga taxifolia*] made very satisfactory growth on O'Neill soil inoculated with coniferous humus containing mycorrhizal fungi. On uninoculated soil fertilized with phosphorus, White Pine seedlings formed mycorrhizae and made satisfactory growth; but Douglas Fir seedlings, although responding moderately to phosphorus fertilization, did not form mycorrhizae nor maintain normal growth rates. Excepting uninoculated Douglas Fir, good growth in every instance was associated with high phosphorus absorption. The fact that Douglas Fir made poorer growth on uninoculated, fertilized plots than on inoculated plots, even though seedling phosphorus levels were high, and no response was being obtained from nitrogen and potassium, suggests a mycorrhizal stimulus above that directly due to phosphorus. It is suggested that the stimulating effect of mycorrhizal fungi on conifer seedlings is due to heightened metabolism, associated in this instance with transfer of phosphorus and growth stimulators from fungus to seedling. *Authors' summary.*

11.47. Maintenance of Favourable Soil Conditions

See also *For. Abstr.* 8 (No. 1402).

[886]. 11.47.13 : 12.25. RÖMER, A. Boden- und Streuuntersuchung sowie Kostenaufstellung zum vorstehenden Forstdüngungsversuch. **[Investigation of soil and litter and statement of costs in connexion with the foregoing forest manurial trial.]** *Forstwiss. Cbl.* 62 (4), 1940 (89–94). [G.g.]

Supplement to the paper noted in *For. Abstr.* 3 (104). Tests 5 and 10 years after the start of the experiment showed that the acidity of the upper soil layers was markedly reduced by the liming, though in the lower layers only a small decrease was observed. Preliminary attempts to determine soil compactness with von Meyenburg's soil hardness meter showed that the soil differences were too great for successful application of this method, but nevertheless suggested that the method of cultivation used (removal of moss growth and light loosening with a mattock) had been unfavourable. The needles in litter of the limed plots had a CaO content about 15 per cent. higher than those on unlimed plots. A table of costs is presented as a rough basis for economic calculations.

11.6. *Hydrographical Conditions. Water and Soil Conservation*

See also *For. Abstr.* 8 (Nos. 1531–3).

[887]. 11.6. FRANK, B., and BETTS, C. A. **Water and our forests.** *Misc. Publ. U.S. Dep. Agric.* No. 600, 1946. pp. 29.

A pamphlet designed to impress the general public with the benefits derived from proper management and adequate afforestation of catchment areas and the dangers arising from mismanagement.

[888]. 11.62.11 (54.7). SAUSMAN, V. A. N. **Land improvement in the Province of Bombay.** *Indian For.* 72 (3), 1946 (115–8). (6th Silvicultural Conference, Dehra Dun, 1945.)

An account of land-improvement works in the Bijapur district of Bombay Province, a generally treeless tract particularly liable to sheet and gully erosion. This has hitherto been unchecked by any physical means on a wide scale, except for some cross bunds erected across the wider *nalla* beds. The general causes of the extensive sheet erosion are enumerated. In accordance with present policy, all lands under cultivation and likely to be brought under cultivation within 10 years are treated by bunding, whereas waste lands not likely to be cultivated within 10 years are treated by trenching. In doubtful cases, every third trench is made into a bund, but the treatment is otherwise the same as for trenched land. The author deals primarily with the trenched areas in which the main objects are: (1) to impound the water and silt and thus assist infiltration; (2) to improve soil quality by utilizing the impounded water to weather the subsoil; (3) to raise the subsoil water level in the surrounding country; (4) to improve pasture; (5) to increase the area under cultivation by the provision of subsoil water and the formation of subsoil; (6) to meet domestic needs for small timber and fuel; (7) to create windbreaks.

In the first year of work, about 34,000 acres of land were trenched, forming (together with the lands bunded) an almost continuous line of improved work 40 miles in extent. Although trench digging was not commenced until the south-west monsoon was well advanced and the correct sowing period was lost, 3-4,000 acres of trenched lands were sown during the 1943 monsoon and the remainder during the 1944 monsoon. In spite of two months' drought during each of the two monsoon seasons, the height growth of seedlings during the first 15 months was very satisfactory. Figures are given showing the maximum and average height growth of *Cassia siamea*, *Hardwickia binata*, *Azadirachta indica*, *Tamarindus indica*, *Anacardium occidentale*, *Butea frondosa*, and *Ougeinia dalbergioides*.

As a horizontal spacing of 70 ft. between the trenches did not give enough water in a trench to help the young seedlings over the two months of drought aggravated by strong winds the spacing was later increased to 150 ft., but the consequent erosion was so heavy that continuous trenches had to be abandoned in favour of trenches 200 ft. in length alternating with gaps of 3 ft. In a few years the grass and forest stand is expected to act as an anti-erosion measure of first importance. In the steeper parts of the country, where run-off is quicker, the spacing of the trenches must be reduced.

[889]. 11.62.11 : 23.3. MESSINES DU SOURBIER, J. Reboisements et glissements. **[Reafforestation and landslides.]** *Rev. Eaux For.* 82 (6), 1944 (319–40 + plates). [F.]

Discussion of an article by J. Goguel [see *For. Abstr.* 7 (No. 485)] on the possible effect of afforestation in causing landslides. The author analyses the course and apparent causes of a number of landslides in mountain areas, and draws the following conclusions: Forest cover is sometimes powerless to stop landslides, which may start and develop in a forest. In a continuous stand, however, they are always narrowly localized, except in the case of great cataclysms. Landslides are more numerous and more extensive on non-forest land. The halting of landslides, except in numerous incurable cases, is best effected by regulation of the hydrological régime: stream diversions, either in tunnel or open, and deep or superficial drainage. The best results are obtained by supplementing the drainage works by afforestation. The author maintains that, in the instance adduced by Goguel, the landslides were, in fact, anterior to the afforestation.

[890]. 11.62.11 : 23.3 : 12.29 : 12.14.3. WHITE, D. G., and CHILDERS, N. F. **Bamboo for controlling soil erosion.** *J. Amer. Soc. Agron.* 37 (10), 1945 (839–47). L.S.

A general account is given of the use of Bamboo in Puerto Rico for erosion control. A study was made on a clump of *Bambusa tulda*, in order to ascertain the distribution of roots in the soil, and it was found that 83 per cent. of the roots were present in the upper foot of the soil, which is the area where roots serve best in controlling erosion. The greatest concentration of roots was within a horizontal radius of 4 ft. of the clump. The leafy mulch which accumulates beneath some species of Bamboo (e.g. *B. longispiculata*) collects and conserves moisture in addition to preventing soil erosion. Notes are given on the species most suited to conditions in Puerto Rico and on methods of planting.

[891]. 11.62.11 : 91.3. STEBBING, E. P. **Erosion and water supplies.** With discussion. *Indian For.* 72 (4), 1946 (177–89). [Paper read before the Royal Society of Arts, 28th February, 1945.]

A comprehensive survey of soil erosion in relation to water supply as illustrated by examples from all parts of the world, particularly the British Empire. The author believes that strict closure to cultivation, grazing, firing and cutting (supplemented, if necessary, by afforestation) is the cheapest and most promising method of checking erosion. Engineering works such as gully plugging, check damming and contour trenching are only useful as auxiliary measures and cannot be regarded as the principal method of attacking the erosion problem. He considers that the value of forests in conserving rainfall and distributing the run-off evenly is definitely proved for tropical and semi-tropical regions but is by no means settled for temperate parts of the world.

The author suggests the formation of an African International Commission representing the four countries chiefly concerned (Britain, France, Belgium and Portugal) to investigate the question of soil erosion in Africa. The findings of an authoritative commission of this kind would probably be accepted by other governments interested in the same problem.

12. FOREST BOTANY. TREE SPECIES

12.1. *General Botany*

12.11. Physiology. Reproduction. Growth

See also *For. Abstr.* 8 (No. 878).

12.11.1. *Metabolism. Plant Constituents. Absorption. Translocation. Growth Substances*

See also *For. Abstr.* 8 (No. 1402).

[892]. 12.11.11 : 12.26–8. VINCENT, D., and MATHOU, T. Action inhibitrice du Buis (*Buxus sempervirens* L. et *Buxus balearica* Willd.) sur la cholinestérase du sérum. **[Inhibiting effect of Box (*Buxus sempervirens* and *B. balearica*) on the cholinesterase of serum.]** *C.R. Acad. Sci., Paris* 220 (13), 1945 (474–6). [F.] D.S.I.R.

[893]. 12.11.11 : 12.26–8. CHOLLET, M.-M. Le stachyose dans *Catalpa bignonioides*. **[Stachyose in *Catalpa bignonioides*.]** *C.R. Acad. Sci., Paris* 222 (4), 1946 (242–4). [F.] D.S.I.R.

Stachyose is to be found in greatest quantity in the outer layers of large roots, but is also found in the woody portion of these roots and

in smaller roots. Branches, lignified and non-lignified, contain 3 to 4 per cent. of stachyose. Leaf blades and petioles contain none at all and the fruits very little, though it exists in fairly large quantities in the seed kernels. It is noted that the Bignoniaceae come midway between the Labiatae and the Scrophulariaceae in which stachyose is also to be found.

[894]. 12.11.11 : 31.3. HÖBER, R., and collaborators. **Physical chemistry of cells and tissues.** J. & A. Churchill Ltd., 104 Gloucester Place, Portman Square, London. 1945. pp. xiii + 676. Price 42*s*. [Univ. of Pennsylvania School of Medicine, Philadelphia, Pa.]

[895]. 12.11.12. DELF, E. M. **Translocation of copper ions in plants.** *Nature, Lond.* 157 (3994), 1946 (666–8). [Westfield College, Univ. of London.]

An account of the use of a technique involving the application of a mixture of copper sulphate, calcium chloride and ordinary soil to barked stems in order to trace the translocation of solutes by the movement of the copper ions. The path and rate of travel of the copper ions appeared to be influenced by the specific nature and water relations of the plant and by the degree of differentiation of the tissues. Although xylem and phloem were involved in varying degree, the movement took place chiefly in the phloem and was primarily upwards.

[896]. 12.11.12 : 12.14.3 : 12.25. KRAMER, P. J. **Absorption of water through suberized roots of trees.** *Plant Physiol.* 21 (1), 1946 (37–48). [U.S. Bureau of Plant Industry, Beltsville, Md.] O.B.D.

The rate of water absorption through suberized roots (diam. 3·2 to 17·0 mm.) of Shortleaf Pine [*Pinus echinata*] was determined by attaching potometers to roots of small trees growing in the open. Measurable absorption occurred through all roots studied.

Comparison of rates of water movement through segments of Pine and Dogwood roots showed that the latter are much the more permeable to water.

Absorption of water through suberized roots is probably of vital importance in evergreen trees during the winter, when root growth is much reduced or ceases and the roots become suberized to their tips. It is probably also of some importance in the summer, particularly immediately following a drought which has stopped root elongation. *From author's summary.* [Cf. *For. Abstr.* 8 (No. 655).]

[897]. 12.11.12 : 12.14.3. ADDOMS, R. M. **Entrance of water into suberized roots of trees.** *Plant Physiol.* 21 (1), 1946 (109–11). [Duke Univ., Durham, N.C.] O.B.D.

Entrance of water into old suberized roots of Yellow Poplar [*Liriodendron tulipifera*], Shortleaf Pine [*Pinus echinata*], and Sweet Gum [*Liquidambar styraciflua*] was proved by means of coloured solutions. Much more dye was observed in Yellow Poplar than in Shortleaf Pine. Sweet Gum appeared to be intermediate between the two. Water entered through lenticels, breaks round branch roots, and wounds.

12.11.2. *Reproduction. Propagation*

[898]. 12.11.21 : 12.26–8 : 12.14.7. JAEGER, P. Épanouissement et pollinisation de la fleur du Baobab. **[The unfolding and pollination of the Baobab flower.]** *C.R. Acad. Sci., Paris* 220 (11), 1945 (369–71). [F.] D.S.I.R.

A description is given of the flower of *Adansonia digitata* L., the stages in its rapid, nocturnal unfolding and its pollination by bats (*Eidolon helvum* Kerr), which are attracted by a nectar secreted at the base of the petals. The flower is also adapted to wind pollination, having large quantities of dry pollen and highly developed stigmatic papillae.

[899]. 12.11.22 : 12.11.15 : 23.27. MYHRE, A. S., and SCHWARTZE, C. D. **Hormones and the propagation of certain evergreens.** *Arbor. Bull., Wash.* 8 (2), 1945 (14–5, 20–4).

Among the subjects briefly discussed are propagating structures, time of taking cuttings, selection and preparation of cuttings, the rooting medium, handling the cuttings, and bottom heat, with particular reference to the rooting of woody evergreens.

Very satisfactory results were obtained by soaking the basal portion of the cutting for 24 hours in a solution of 60 parts of indolebutyric acid in 1,000,000 parts of water. Chemical treatment was effective only when the propagating frame maintained bottom heat at 70–72° F.

[900]. 12.11.22 : 12.25 : 12.11.15. GRACE, N. H., and FARRAR, J. L. **Vegetative propagation of conifers. XIII. Rooting of**

Norway Spruce cuttings in the greenhouse. *Repr.* from *Canad. J. Res.* 23C, 1945 (150–65). *N.R.C.* No. 1319.

Greenhouse propagation of Norway Spruce (*Picea abies*) cuttings in various media containing sand and peats resulted in 80 per cent. rooting in a peat-humus/sand medium. Canadian peat moss and Swedish peat media were inferior, but the weekly addition of potassium acid phosphate and magnesium sulphate solutions to a Swedish peat medium resulted in the rooting of 96 per cent. of the cuttings. Beneficial effects of peat humus were related to available nutrient materials. Peat humus extracted with methyl alcohol and acetic acid did not affect rooting, but sodium hydroxide extraction, hot water extraction, and air drying at 110° C. were harmful. Propagation under sub-optimum conditions disclosed markedly beneficial effects from mixtures and mulches of peats, soil, and active silica, the active silica being particularly favourable in the mulched condition.

Medium cuttings, 3–6 in. long, rooted 96 per cent., and long cuttings, 6–10 in., 71 per cent. Uncovered cuttings and those covered with celloglass were superior in their responses to those under either cheesecloth or factory cotton screens.

Plant hormone chemicals, when applied in a talc carrier dust, tended to reduce rooting of Norway Spruce cuttings; the injurious effects increased progressively with concentration over the range from 500 to 4,000 p.p.m. Indolylbutyric acid showed neither damaging nor beneficial effects. Naphthylbutyric acid and potassium naphthylhexoate, while similar in effect, tended to be less injurious than naphthylacetic acid when used over a range of equivalent molecular concentrations. Application of naphthylbutyric acid at 2,000 p.p.m. level in a charcoal carrier resulted in rooting of 98 per cent. of the cuttings. Mean root length was increased by the application of 50 p.p.m. each of thiamin and nicotinic acid. While nutrient salts and naphthylbutyric acid, each separately, tended to reduce mean root length, the combination had no injurious effect [cf. *For. Abstr.* 7 (Nos. 595–6), 8 (No. 89)]. *Authors' abstract.*

[901]. 12.11.22 : 12.26–8. KAPADIA, G. A. **Anomalous vegetative reproduction by cuttings in *Ficus religiosa*, Linn.** *Curr. Sci.* 14 (1), 1945 (23). [Bahauddin College, Junagadh.] L.S.

The author records the abnormal sprouting of cuttings (6·5–11 in. circumference) of *Ficus religiosa*, used as stakes. Adventitious roots were produced and numerous shoots formed not only in the unusually rainy and sunless weather of the monsoon, but also (in one case) in the dry, hot days of May and June.

12.11.3. *Heredity. Breeding. Races and Questions of Provenance. Cytology.*

[902]. 12.11.3 (47.0). HUDSON, P. S., and RICHENS, R. H. **The new genetics in the Soviet Union.** Imperial Bureau of Plant Breeding and Genetics, School of Agriculture, Cambridge. 1946. pp. 88. [E.e.f.span.g.russ.] Price 6*s.* net.

The so-called genetics controversy in the U.S.S.R. has excited interest in the rest of the world during the last ten years or more. However, many of the views expressed regarding the merits of the Soviet schools of thought based on Mičurin and Lysenko have been inaccurate; the inaccuracy has resulted firstly from the fact that the originals were all published in Russian and biologists in other countries have been unable to consult them; and secondly, from the emotional approach which seems to be so difficult to overcome in dealing with problems affecting the Soviet Union.

The Imperial Bureau of Plant Breeding and Genetics has during all this time kept geneticists informed of the developments, by publishing abstracts of all the chief works published in Russia, and is now able to give a full account of the development of the genetics controversy, based exclusively on the original Russian publications, including many which have only recently become accessible in Great Britain.

It is believed that this bulletin is the first real attempt to place before the public an impartial statement of the position, without prejudice either in favour of or against the Lysenko school. Where appropriate, the original words of the authors have been quoted, in English in the body of the text and in the original Russian in footnotes.

The historical study of the subject has revealed many interesting new points of view; for example, the immense importance of

national psychology in the development of schools of thought in the Soviet Union; the importance of the emotional as opposed to the deductive method of argumentation; and the fact that most of what have been regarded as the more fantastic concepts of Lysenko and his school are in reality direct or indirect paraphrases of concepts current at the time of Darwin and Timirjazev. Genetical thought has undergone many changes since those days and consequently many of Lysenko's criticisms are no longer valid. Genetical principles are, however, still changing and open to change, and some of Lysenko's criticisms may, even though not in the form he suggests, nevertheless embody a grain of truth; where this is so an attempt has been made to do him justice.

It is thought that this account will prove interesting and instructive, not only to pure geneticists and plant and animal breeders, but to a wide range of general readers in the field of biology and indeed to anyone interested in the history of science.

[903]. 12.11.3 : 12.25. GUINIER, P. Arbres et forêts: notes botanico-forestières. [**Trees and forests: notes on forest botany.**] *Rev. Eaux For.* 82 (6), 1944 (313–8 + plates). [F.]

A note on a group of three branchless Firs found growing close together in the forest of Bertrichamps (Meurthe-et-Moselle). The stem is very thin, ½-cm. diameter at most, and 75–80 cm. high. The roots are very short and only slightly ramified. The scars left by the fall of bud-scales enable the annual growth to be distinguished, and the trees were apparently 30 years or more old. They were apparently the result of a mutation characterized by abortion of the lateral buds.

[904]. 12.11.3 : 12.25 : 21.0 (494). AUER, C. Mathematisch-statistische Untersuchung über das Jugendwachstum von Lärchen verschiedener Herkunft im Lehrwald der ETH. [**Statistical investigation of the early growth of Larches of different provenance in the Instructional Forest of the Swiss Federal Technical College.**] *Schweiz. Z. Forstw.* 97 (6), 1946 (224–43). [G.g.f.]

The present results show that in addition to the unexpectedly large differences in growth, at least in youth, reported by previous workers for Larches from different geographical regions, there is considerable variation in the increment of Larches from different sites within the same general area of distribution. In general, the wider the difference in climate between the localities of origin, the more pronounced are the racial differences. The species *Larix decidua* Mill. (*L. europaea* Lam. et DC.) must be considered as a very complex aggregate of varieties, subvarieties, local types and races, very closely adapted to their stations. So far as the Swiss Plateau is concerned, the conclusion is that old Larch plantations which appear to be of good race though of unknown provenance, are valuable sources of seed, having stood a partial test in this locality. In the natural area of Larch in Switzerland it is clear that races exist which differ markedly in morphology and physiology, and whose behaviour in any given case is insufficiently known, so that it is impossible as yet to indicate the race that will suit a particular site in all respects. The chief conclusion is that, so far as possible, seed should be collected from the immediate vicinity of the area to be regenerated. Future research must define what races exist and settle many questions regarding their employment in practice. *From author's summary.*

[905]. 12.11.3 : 12.25 (44). JACQUES, P. Les pins sylvestres dans le Massif Central. [**The Scots Pine in the Central Massif.**] *Rev. Eaux For.* 79 (10), 1941 (711–20). [F.]

A description of the very superior race of Scots Pine found in the Forez mountains of the Central Massif, and of the steps that have been taken to preserve it by seed collection.

[906]. 12.11.3 : 12.25 (44). Les forêts de pin sylvestre des Vosges. [**The forests of Scots Pine in the Vosges.**] *Rev. Eaux For.* 79 (11), 1941 (799–821). [F.]

An account of the indigenous races of Scots Pine in the forests of the Vosges. There are two forms, a mountain one and an intermediate one. Imported strains are grown on the plains.

[907]. 12.11.3 : 12.26–8. JOHNSON, L. P. V. **Fertilization in *Ulmus* with special reference to hybridization procedure.** *Canad. J. Res.* 24C (1), 1946 (1–3). P.R.

Germination tests on fruits derived from open, self, and cross pollinations made in *Ulmus* during four seasons strongly indicate a high degree of self sterility, possibly due to protogyny. It is suggested that a hybridization procedure involving the cross pollination of

non-emasculated flowers is feasible in many species of the genus, especially under conditions that permit large-scale crossing and the growing of fairly extensive populations from which selfed seedlings may be eliminated. *Author's summary.*

[908]. 12.11.3 : 12.26–8. ASANA, J. J., and ADATIA, R. D. **The chromosome numbers in the family An[n]onaceae.** *Curr. Sci.* 14 (3), 1945 (74–5). [Gujarat College, Ahmedabad; Wilson College, Bombay.] L.S.

A study of the somatic divisions in the root-tips revealed that the diploid number of chromosomes is 14 in *Annona squamosa* and *A. reticulata*, 16 in *Artabotrys odoratissimus* and 18 in *Polyalthia longifolia*. This confirmed the haploid number of chromosomes previously noted in the latter two plants as 8 and 9 respectively.

[909]. 12.11.3 : 12.26–8 (82). CASTRONOVO, A. Estudio cariológico de doce especies de Leguminosas argentinas. [**Cytological study of twelve species of Argentine Leguminosae.**] *Darwiniana* 7 (1), 1945 (38–57 + plate). [Span.span.] O.B.D.

Chromosome counts for 12 Argentine species of *Gleditsia*, *Acacia*, *Prosopis*, *Sesbania* and *Adesmia*.

12.13. Embryology

[910]. 12.13 : 12.26–8. SWAMY, B. G. L. **A preliminary note on the embryology of *Casuarina equisetifolia*, Forst.** *Proc. Indian Acad. Sci.* 20B (5), 1944 (187–91). L.S.

[911]. 12.13 : 12.26–8 : 12.14 (67.5). GILBERT, G. Observations préliminaires sur la morphologie des plantules forestières au Congo belge. [**Preliminary observations on the morphology of forest seedlings in the Belgian Congo.**] *Publ. Inst. nat. Étude agron. Congo belge* No. 17, 1939. pp. 28. [F.]

The practical aim of this work is the identification of young seedlings on the forest floor, but the study of the foliar system in its early stages may be helpful in clearing up points of doubtful taxonomy. The writer considers first the characters of the fruit, which often gives valuable indications when still adhering to the seedling, the seed, type of germination, and description of the constituent parts of the seedling up to the appearance of adult elements. The second part of the pamphlet consists of a table of the chief Congo forest species with means of identifying their seedlings.

[912]. 12.13 : 12.26–8. CAMUS, A. Soudure des cotylédons dans le genre *Lithocarpus* Blume. [**Union of the cotyledons in the genus *Lithocarpus*.**] *Bull. Mus. Hist. nat., Paris* (*2e Sér.*) 14 (6), 1942 (461–2). [F.] L.S.

Although union of the cotyledons occurs in certain species of *Lithocarpus*, it is not a general feature characteristic of any of the subgenera.

12.14. Organography. Morphology. Anatomy. Histology

[913]. 12.14 : 12.26–8. CHESNAIS, F. Recherches sur l'anatomie du genre *Hoplestigma* Pierre. [**Research on the anatomy of the genus *Hoplestigma*.**] *Bull. Mus. Hist. nat., Paris* (*2e Sér.*) 15 (4), 1943 (226–30). [F.] L.S.

A study of the anatomy of the stem, leaf and fruit, with special reference to the taxonomical position of the genus.

[914]. 12.14.2 : 12.26–8. VENNING, F. D. **Accessory vascular bundles in *Murraya koenigii* (Linn.) Spreng. (Rutaceae: Aurantioideae).** *J. Wash. Acad. Sci.* 35 (11), 1945 (352–6). [Univ. of Miami.] L.S.

[915]. 12.14.3 : 21.2. OPPENHEIMER, H. R. **Root cushions, root stalagmites and similar structures.** *Repr.* from *Palest. J. Bot.* (*R. Ser.*) 4 (1), 1941 (11–9).

The main factors determining the rate of formation and the eventual size of root cushions and root stalagmites found under dripping taps are: (1) rate of dripping of the tap; (2) air temperature; (3) air humidity; (4) vigour of the mother plant and its roots; and, possibly, (5) amount of moisture available to the remaining roots of the mother plant. The author describes the formation and appearance of these and similar structures and discusses the possible rôle of positive hydrotropism in causing them. As a rule, the accumulation of roots under dripping taps does not develop much beyond the root-cushion stage in sunny localities.

[916]. 12.14.7 : 12.26–8. SMITH, E. C. **Anther color in Willows.** *Amer. Midl. Nat.* 34 (2), 1945 (440–4). [Botany and Plant Pathology Department, Colorado A. & M. College, Fort Collins, Colo.]

Some shade of red is present in the mature but unopened anthers of certain Willows of

the northern Rocky Mountain area, and this colour provides a good supplementary key character for freshly gathered material. In some species the colour undergoes changes during anthesis which may also be of diagnostic value. There appears to be some correlation between a distinctive dark colour of unopened anthers in dried specimens and an original red colour in fresh ones, but anther colour can be used effectively to identify herbarium specimens only after such correlations have been established and when fairly mature unopened anthers are present. The study covers too limited a field to warrant any statement of the constancy of the phenomena reported, and further data are solicited from other parts of the United States and Canada.

12.19. Geographical Distribution. Plant Geography and Sociology

[917]. 12.19 (42.1–8) : 13.15 : 09.1. FITTER, R. S. R. **London's natural history.** *New Naturalist Series.* Collins, St. James's Place, London. 1945. pp. xii + 282 + plates. Price 16*s*.

In this book are collected from diverse sources many facts on the development of the fauna and flora of the London area from early times to the present with a critical assessment of the influence of biotic factors. Information on woodlands and tree growth is considerable but is dispersed throughout the general story.

[918]. 12.19 (67.6). THOMAS, A. S. **The vegetation of some hillsides in Uganda. Illustrations of human influence in tropical ecology.** *J. Ecol.* 33 (1; 2), 1945–46 (10–43; 153–72 + plates). [Department of Agriculture, Uganda.]

The catena system is used to describe the belts of vegetation on six hillsides in Uganda. There are great differences between the plant formations of the zones on each hill. In general, the two most southerly catenas show belts of short grassland on the hillsides, with closed evergreen forests on the tops and at the bases of the hills. The two central catenas are remarkable for the thickets of elephant grass on the hillsides. The two northern catenas have woodlands on the tops and sides of the hills and more or less open grassland in the valleys. Short descriptions are given of the soils; the secondary nature of the vegetation is discussed and the ways in which man has altered the plant formations, by cutting down forests, by burning, by the conscious and unconscious encouragement of some indigenous species and by the introduction of exotic species. Human influence is a factor of great importance in tropical ecology, and must be considered in relation to the present aspect of vegetation in equatorial regions, and to the changes which are taking place. *From author's summary.*

[919]. 12.19 (77.4). GRAHAM, S. A. **Ecological classification of cover types.** *J. Wildlife Mgmt.* 9 (3), 1945 (182–90). [Univ. of Michigan, Ann Arbor, Mich.] B.A.P.

The Michigan system of classification for cover mapping comprises (1) Upland types: porous soils, non-porous soils, and rock outcrops. (2) Lowland types of aquatic origin: bogs (seepage and stagnant) and marshes (seepage and stagnant). (3) Transition types: flood plain and transition belts. Development to the climax type is divided into 10 arbitrary stages. Any degree of detail can be obtained by means of appropriate symbols, but extreme detail is neither necessary nor desirable. The author hopes that the Michigan system may serve as basis for a universally acceptable system of cover mapping.

[920]. 12.19 (78.8). WILLIAMS, T. E., and HOLCH, A. E. **Ecology of the Black Forest of Colorado.** *Ecology* 27 (2), 1946 (139–49).

The factors measured in this study were evaporation rate, wind velocity, rainfall, air temperature, relative humidity, hygroscopic coefficient, and water content of the soil. The Pine, scrub Oak, and grassland habitats differed only slightly in the factors measured, and the slight differences are probably to be attributed to the presence of the three dominant types of vegetation. The probable cause of the zonation into Pine, scrub Oak and grass is the difference in soil texture of the three habitats, together with its effect upon the hygroscopic coefficient, and the resulting quantities of water available to plants. The growth of Ponderosa Pine at the tops of the knolls rather than at their bases is aided by the presence of horizontal sandstone strata at a depth of 3 ft. or less from the surface at the tops of the hills. The sandy soil above these strata is well adapted to retaining enough moisture to secure the germination and establishment of Ponderosa Pine. *From authors' summary.*

[921]. 12.19 : 12.26–8 (74.1). BEAN, R. C. ***Betula papyrifera* var. *commutata* in western Maine.** *Rhodora* 47 (564), 1945 (405). O.B.D.

[922]. 12.19 : 12.26–8 (45). FENAROLI, L. Note sull'ecologia e distribuzione dei pioppi in Italia. **[Notes on the ecology and distribution of Poplars in Italy.]** *Bosco* Feb., 1945 (2). [It.] X.

[923]. 12.19 : 12.26–8 (42.9) : 12.11.3. WILKINSON, J. **Some factors affecting the distribution of the Capreae group of *Salix* in Gower.** *J. Ecol.* 33 (2), 1946 (214–21).

An account is given of the distribution in Gower of this group, comprising the three species *S. caprea*, *S. aurita*, and *S. atrocinerea*, and the naturally occurring hybrids between them. The effects of the physical features and the geology of the area, especially as these affect soil production, are discussed, and they are shown to be particularly important in connexion with the occurrence of the *caprea* complex. The adaptational value of rooting characteristics is also noted, especially in relation to the habitat factors which condition the segregation of *S. caprea* from the other two species. *From author's summary.*

[924]. 12.19 : 12.26–8. MOLDENKE, H. N. **The known geographic distribution of the members of the Verbenaceae and Avicenniaceae: supplement 4.** *Amer. J. Bot.* 32 (9), 1945 (609–12). [New York Botanical Garden, New York 58.] O.B.D. Cf. *For. Abstr.* 7 (Nos. 108, 623), 8 (Nos. 974–6).

12.19.1. *Regional Floras, including Check Lists*

[925]. 12.19.1 (410). **British Ecological Society: check-list of British vascular plants.** *J. Ecol.* 33 (2), 1946 (308–47).

The purpose of this Check List is not to provide an authoritative statement on the content and taxonomy of the British flora, but to secure uniformity of nomenclature in contributions to the Biological Flora. Contributors will be asked always to use the names appearing in the list unless they can give adequate reasons for doing otherwise. This will obviate the necessity for citing the authorities for names, since it will be understood that the authorities are those cited in the Check List. On p. 291 is given a list of the parts of the Biological Flora of the British Isles already published or in preparation.

[926]. 12.19.1 (44) : 09.7. LACHAUSSÉE, E. Les forêts du premier plateau du Jura: étude géobotanique et forestière. **[The forests of the first plateau of the Jura: a geobotanical and forestry study.]** *Rev. Eaux For.* 80 (2), 1942 (81–98 + plates). [F.]

[927]. 12.19.1 (61). GUINIER, P. Flore forestière, forêts et économie forestière en Afrique du nord d'après des travaux récents. **[Forest flora, forests and forest economy in North Africa, as discussed in recent literature.]** *Rev. Eaux For.* 81 (11; 12), 1943 (585–603; 643–61). [F.]

[928]. 12.19.1 (71) : 01.6. ROULEAU, E. Bibliographie des travaux concernant la flore canadienne, parus dans 'Rhodora' de 1899 à 1943 inclusivement, précédée d'un index alphabétique de tous les noms botaniques nouveaux proposés dans cette revue. **[Bibliography of works on the Canadian flora appearing in *Rhodora* from 1899 to 1943, inclusive, preceded by an alphabetical index of all the new botanical names proposed in that journal.]** *Contr. Inst. bot. Univ. Montréal* No. 54, 1944. pp. 367. O.B.D.

[929]. 12.19.1 (728.1 : 728.2). STANDLEY, P. C., and STEYERMARK, J. A. **Flora of Guatemala, IV.** *Fieldiana* (*Bot.*) 24 (4), 1946 (v + 1–493). *Field Mus. Publ.* No. 577.

[930]. 12.19.1 (85). MACBRIDE, J. F. **Flora of Peru.** *Bot. Ser. Field Mus. nat. Hist., Chicago* 13 (pt. 3, no. 1), 1943 (1–507+ii). *Field Mus. Publ.* No. 531.

[931]. 12.19.1 (85). MACBRIDE, J. F. **Flora of Peru.** *Bot. Ser. Field Mus. nat. Hist., Chicago* 13 (pt. 4, no. 1), 1941 (1–566 + ii). *Field Mus. Publ.* No. 496.

[932]. 12.19.1 (86 : 85). SVENSON, H. K. **Vegetation of the coast of Ecuador and Peru and its relation to the Galapagos Islands. I. Geographical relations of the flora. II. Catalogue of plants.** *Amer. J. Bot.* 33 (5; 6), 1946 (394–426; 427–98). [Brooklyn Botanic Garden, Brooklyn, New York.] O.B.D.

[933]. 12.19.1 (74.8). MOLDENKE, H. N. **A contribution to our knowledge of the wild and cultivated flora of Pennsylvania.**

Amer. Midl. Nat. 35 (2), 1946 (289–399). [New York Botanical Garden, New York, N.Y.]

[934]. 12.19.1 (75.2). NORTON, J. B. S., and BROWN, R. G. **A catalog of the vascular plants of Maryland.** *Castanea* 11 (1), 1946 (1–50).

[935]. 12.19.1 (75.6). HOLMES, J. S. **Common forest trees of North Carolina: how to know them. A pocket manual.** North Carolina Department of Conservation and Development, Raleigh, N.C. 5th ed., 1944. pp. 87.

[936]. 12.19.1 : 12.19.4 : 21. GAUSSEN, H. Les arbres méditerranéens. **[Mediterranean trees.]** *Rev. Eaux For.* 79 (6; 7), 1941 (395–412; 488–505 + plates). [F.]

An account of the distribution, succession, and silvicultural characters of the indigenous trees of the Mediterranean area.

12.19.2. *Forest Types*

See also *For. Abstr.* 8 (Nos. 1402, 1497).

[937]. 12.19.2. SCHAEFFER, L. Les types de forêt de Cajander. **[Cajander's forest types.]** *Rev. Eaux For.* 82 (5), 1944 (245–63). [F.]

An account of Cajander's classification of forest types, and some applications of it made by later writers.

[938]. 12.19.2 (489) : 12.19.3 : 12.26–8. GRAM, K., JØRGENSEN, C. A., and KØIE, M. De jydske Egekrat og deres Flora. **[The Jutland Oak scrub and its flora.]** *K. danske vidensk. Selsk. biol. Skr.* 3 (3), 1944. pp. 210. [Dan.] Biol. Abstr. 20 (6), 1946 (9645).

[939]. 12.19.2 (494) : 04.4. ETTER, H. Zur Vegetationskarte des Sihlwaldes der Stadt Zürich. **[On the vegetation map of the Sihlwald of the city of Zürich.]** *Schweiz. Z. Forstw.* 97 (5; 6), 1946 (185–94; 244–54). [G.f.]

Notes to accompany the actual map (to be published with the present paper when issued as a separate), consisting of a review of the importance of plant ecology in forestry and of the development of recognition of its importance, notes on the character and functions of vegetation maps and of the Sihlwald map in particular, and some account of the chief forest communities, viz. moist Maple/Ash forest (*Acereto-Fraxinetum caricetosum pendulae*), the forests with Yew on steep slopes (*Taxeto-Fagetum*), and the Beech forests proper (*Fagetum festucetosum altissimae* and *Fagetum finicola*).

[940]. 12.19.2 (728.2). NELSON SMITH, J. H. **Forest associations of British Honduras, II, III.** *Carib For.* 6 (1–2; 3), 1945. (45–70; 131–58). (E.span. f.]

For the first article in this series, see *For. Abstr.* 4 (157). The associations here described are the *Orbignyá/Dialium/Virola* high forest, Broken Ridge association, Chiclé forest association, Bamboo associations. Descriptions are based on data collected from sample plots intensively studied by the author.

[941]. 12.19.2 (729.7) : 12.26–8. BEARD, J. S. **The Mora forests of Trinidad, British West Indies:** *J. Ecol.* 33 (2), 1946 (173–92).

The Mora forest of Trinidad in which *Mora excelsa* Benth. is dominant and gregarious occupy certain restricted areas. No environmental factors appear to account for the alternation of Mora forest and mixed *Carapa/Eschweilera* forest. Mora is believed to be a recent arrival in the island and to be actually invading the mixed forests. It is of wide distribution in Guiana, where it is occasional in most types of rain forest, becoming gregarious only on swampy flats where competition is lessened. It is believed to have crossed over to Trinidad by a land bridge in late Pleistocene to sub-recent times. Mora is thought to have become gregarious in Trinidad because the moist forests are not typical rain forests, but have a more open structure. Shade is sufficiently thin to enable Mora to become established readily, after which its great reproductive power makes it gregarious and its greater height suppresses the mixed forests. *Author's summary.*

[942]. 12.19.2 (729.9). STEHLÉ, H. **Forest types of the Caribbean Islands. Part I.** *Suppl.* to *Carib. For.* 6, 1945 (273–414 + map).

The first half of a detailed study of the relations of soil and climate to the forest types of the Caribbean Islands, with particular reference to the French Antilles. After discussing definitions and concepts of forest types as given by various authors and considering the criteria on which a classification of forest types should be based, the author proposes the following classification of Caribbean forest

types: mangrove, xerophytic forests, mesophytic forests, hygrophytic forests, and altitudinal forests. The first three of these types are treated in this half of the study, and for each the following aspects are considered: definition, sub-types, and facies; locality and range; soil conditions; climatic conditions; structure and composition; forest physiognomy and leaf morphology; floristic composition and stratification; reproduction; evolution and succession; stages preliminary to agriculture and forestation; biotic factors. There is a map showing forest type zones of the Islands, and thirteen other maps, graphs and diagrams.

[943]. 12.19.2 (77.6) : 12.19.4. BUELL, M. F., and GORDON, W. E. **Hardwood-conifer forest contact zone in Itasca Park, Minnesota.** *Amer. Midl. Nat.* 34 (2), 1945 (433–9). [North Carolina State College, Raleigh, N.C.]

In Itasca Park, Minnesota, Maple/Basswood stands representative of the climax forest to the south and south-east, and Spruce/Fir stands representative of the climax forest to the north and north-east come into direct contact with each other. Both forest communities appear to be approaching their climatic limits, and any determination of the climax must be based not so much on distribution as on the relative competitive ability of the two communities under present conditions of soil and physiography. The results of the present study indicate that water is not of primary importance in preventing the advance of Maple/Basswood ground cover and reproduction into the Spruce/Fir stand, but that the low light penetration (less than 5 per cent.) characteristic of the Fir canopy completely prevents a hardwood invasion. The Spruce/Fir community seems at present to be retaining its position in all the areas fully occupied by it. Although some apparent infiltration of the hardwoods by elements of the conifer community suggests that recent climatic fluctuations favour the Spruce/Fir forest over the Maple/Basswood, sufficient evidence is not yet available to show whether the former community will eventually supersede the latter and become the climax vegetation of the area.

12.19.4. *Succession*

[944]. 12.19.4 : 11.48.5. LOCKET, G. H. **Observations on the colonization of bare chalk.** *J. Ecol.* 33 (2), 1946 (205–9 + plate).

A record of observations begun in 1933, on a chalk pit abandoned in 1929. It is probable that this represents an extreme case of the type of colonization which occurs in the absence of rabbit grazing, namely, progress to woodland without intermediate formation of a stable herbaceous association. The woody species on the floor area include *Salix caprea*, *S. cinerea*, *Betula alba*, *Acer pseudoplatanus*, *Crataegus monogyna*, *Fraxinus excelsior*, *Quercus robur*. On the screes, *Salix* and *Betula* spread and grew rapidly in spite of severe attacks by rabbits in the winter of 1933–4. They exploit the pulverized top soil and their main roots run horizontally for a distance approximating to the height of the trees. As the soil moves down the slopes, these roots become bared and the *Salix* tends to die when about 6–8 ft. high. *Betula*, exploiting more the lower crevices, survives better. [Cf. *For. Abstr.* 8 (Nos. 881, 1381).]

12.2. *Special [Systematic] Botany*

[945]. 12.2. MOLDENKE, H. N. **A preliminary classification of the plant kingdom to families.** With supplement I. New York Botanical Garden. 1944. pp. 37 + 4. O.B.D.

The main classification is based, with modifications, on the systems of Engler and Gilg, Engler and Diels, and J. Hutchinson (for the Angiosperms), and consists of 938 families arranged under 225 orders. The supplement contains additions and corrections to the original classification, and brings the total number of family names accounted for to 1,560. An alphabetical index to the scientific names of plant families is appended. Invalid names are cross-referenced to the accepted terminology.

12.25-8. Spermatophyta

[946]. 12.25–8 (410). BRIMBLE, L. J. F. **Trees in Britain, wild, ornamental and economic, with some relatives in other lands.** Macmillan and Co., Limited, St. Martin's Street, London. 1946. pp. x + 352 + plates. Price 15*s*.

This book on trees deals with a high proportion of the indigenous and exotic species in Britain, arranging the information in botanical sequence by families or generic groups and allotting to each species a varying amount of detail on diagnostic features, aesthetic appearance, conditions of growth in woodland and in

garden, economic uses and rôle in literature or folklore. The factual data are instructive, well selected and readably compressed. Space is found for numerous quotations from poems, verse, rhymes and the Bible. The introductory section provides a general review of flowering plants, accounts of the structure of broadleaved and coniferous trees and the principles of classification. A successful feature is the variety of methods of reproduction of the illustrations which include line drawings, pencil and water-colour sketches and photographs ranging from the diagrammatic to the artistic.

[947]. 12.25–8 (410) : 09.1. HOWARD, A. L. **Trees in Britain.** Collins, 14 St. James's Place, London. 1946. pp. 48 + plates.

One of the *Britain in Pictures* series, giving general and historical descriptions of some indigenous and introduced species, their place in literature and their uses through the centuries. The 26 illustrations (8 coloured) are a selection from the works of 18th and 19th century and contemporary artists.

12.25. Gymnosperms

[948]. 12.25 (59.6–9). CHEVALIER, A. Notes sur les conifères de l'Indochine. [**Notes on the conifers of Indo-China.**] *Rev. Bot. appl.* Jan.-Mar., 1944 (7–34). [F.] *Abstr.* in *Rev. Eaux For.* 83 (9), 1945 (541).

12.26-8. Dicotyledons

See also *For. Abstr.* 8 (No. 1104).

[949]. 12.26–8 (59.6–9) : 12.14.5 : 12.19. JOVET-AST, S. Recherches sur les Anonacées d'Indochine. Anatomie foliaire; répartition géographique. [**Research on the Annonaceae of Indo-China. Foliar anatomy; geographical distribution.**] *Abstr.* in *Ann. Sci. nat.* (*Bot.*) 11 (4), 1943 (128–9). [F.] O.B.D.

[950]. 12.26–8 (7). FERNALD, M. L. **Contributions from the Gray Herbarium of Harvard University—No. CLIX. II. Eastern North American representatives of *Alnus incana*.** *Rhodora* 47 (563), 1945 (33–61 + plates). O.B.D.

Alnus incana is a Eurasian species which does not occur naturally in North America. The North American representative is *Alnus rugosa* (DuRoi) Spreng. The other, more southerly, spring-flowering native Alder is *A. serrulata*.

[951]. 12.26–8. SWART, J. J. **Novitates Burseracearum.** *Rec. Trav. bot. néerland.* 39, 1942 (189–210). [E.] O.B.D.

Protium, *Crepidospermum*, *Tetragastris* and *Trattinickia* n. spp. and *Hemicrepidospermum* n. gen.

[952]. 12.26–8. SWART, J. J. **A monograph of the genus *Protium* and some allied genera (Burseraceae).** *Rec. Trav. bot. néerland.* 39, 1942 (211–446). O.B.D.

[953]. 12.26–8 (59.5) : 12.19. SYMINGTON, C. F. **Foresters' manual of dipterocarps.** *Malay. For. Rec.* No. 16, 1941. pp. xliv + 244 + map + chart.

Part I gives the geological history and world distribution of the dipterocarps, and their ecological distribution in the Malay peninsula. Part II consists of keys to groups of Malayan dipterocarps (1) based on bole and bark characters, (2) based on flowers, (3) based on fruit. Part III gives specific descriptions arranged in natural groups. Appendices consist of bibliography, index of scientific names and index of vernacular names. [See also *For. Abstr.* 8 (No. 1090).]

[954]. 12.26–8. VAROSSIEAU, W. W. **On the taxonomic position of *Eucommia ulmoides* Oliv. (Eucommiaceae).** *Repr.* from *Blumea* 5 (1), 1942 (81–92 + chart). X.

The author's examination of morphological and anatomical evidence confirms the view of Van Tieghem (1900) that a monospecific family, closely allied to the Ulmaceae, is justified.

[955]. 12.26–8 (8). CROIZAT, L. **Additions to the genus *Croton* L. in South America.** *Darwiniana* 6 (3), 1944 (442–68). [E.] O.B.D.

Descriptions of 35 new South American species or varieties.

[956]. 12.26–8 (4) : 23.27. IMMEL, R. Die Abstammung der mitteleuropäischen Pyramideichen. [**The origin of the fastigiate Pedunculate Oaks of Central Europe.**] *Intersylva* 1, 1940–1 (312–24). [G.e.f.it.span.]

[957]. 12.26–8 (498). GEORGESCU, C. C., MORARIU, I., CRETZOIU, P. Contribution à la connaissance des variétés et formes roumaines

de chêne. [**Contribution to the knowledge of Rumanian varieties and forms of Oak.**] *Rev. Pădurilor* Sept.–Oct., 1942. pp. 10. [Rum.f.] *Abstr.* in *Rev. Eaux For.* 81 (6), 1943 (297–8).

Key for the identification of the Rumanian varieties and forms of *Quercus robur* L. The two varieties *glabra* and *puberula* are divided into a number of forms based on size and shape of leaves and length of peduncle.

[958]. 12.26–8 (498). PASCOVSCHI. *Quercus virgiliana* Ten. dans la forêt Runceni. [***Quercus virgiliana* Ten. in Runceni forest.**] *Rev. Pădurilor* Sept.–Oct., 1942. pp. 7. [Rum.f.] *Abstr.* in *Rev. Eaux For.* 81 (6), 1943 (298).

Description of a typical stand of a species recently discovered in Rumania. The oldest individuals were 8 m. high and 1 m. in diameter. They mostly grew in mixture with *Q. pubescens.*

[959]. 12.26–8 (72). CAMUS, A. Sur quelques chênes du Mexique. [**On some Mexican Oaks.**] *Bull. Mus. Hist. nat., Paris* (2e *Sér.*) 15 (1), 1943 (88–9). [F.] L.S.

Botanical and taxonomical notes on *Quercus neoplatyphylla, Q. affinis* var. *typica, Q. ocoteaefolia* var. *typica,* and *Q. bourgaei.*

[960]. 12.26–8 (95). WHITE, C. T. ***Papuodendron*, a new genus of arborescent Malvaceae from New Guinea.** *J. Arnold Arbor.* 27 (3), 1946 (272–4 + plate). [Queensland Herbarium, Botanic Gardens, Brisbane, Australia.]

[961]. 12.26–8. BARRETT, M. F. ***Ficus tsjahela.*** *Bull. Torrey bot. Cl.* 73 (1), 1946 (86–90). O.B.D.

Correct spelling of the specific name and synonymy.

[962]. 12.26–8 (88). AMSHOFF, G. J. H. **Notes on the Myrtaceae of Suriname.** *Rec. Trav. bot. néerland.* 39, 1942 (147–65). [E.] O.B.D.

Notes on 10 genera and new species of *Calyptranthes* and *Eugenia.*

[963]. 12.26–8. DWYER, J. D. **The taxonomy of *Godoya* R. and P., *Rhytidanthera* van Tieghem, and *Cespedezia* Goudot (Ochnaceae).** *Lloydia* 9 (1), 1946 (45–61). P.R.

[964]. 12.26–8 (96.9). SHERFF, E. E. **Revision of the Hawaiian members of the genus *Pittosporum* Banks.** *Bot. Ser. Field Mus. nat. Hist., Chicago* 22 (10), 1942 (467–566). *Field Mus. Publ.* No. 521.

[965]. 12.26–8. BREMEKAMP, C. E. B. **On *Urophyllum* Wall. (Rubiaceae) and its nearest allies.** *Rec. Trav. bot. néerland.* 37 (1), 1940 (171–197). [E.] O.B.D.

The *Mussaendeae* and *Hedyotideae* should not be separated into two tribes.

The author discusses the common features of the *Urophyllum* group with a key to the 12 recognized genera, and gives reasons against lumping. Seven new genera (*Didymopogon, Maschalocorymbus, Pravinaria, Rhaphidura, Leucolophus, Lepidostoma,* and *Crobylanthe*) and the previously proposed genus *Stichianthus* Val. are described and several new species and combinations are proposed.

[966]. 12.26–8. BREMEKAMP, C. E. B. **A monograph of the genus *Pleiocarpidia* K. Sch. (Rubiaceae).** *Rec. Trav. bot. néerland.* 37 (1), 1940 (198–236). [E.] O.B.D.

Pleiocarpidia K. Sch., 1897, is a well-defined genus to which 9 species described under *Urophyllum* are now transferred; 16 n. spp. are described. A key to the recognized species of *Pleiocarpidia* is given.

[967]. 12.26–8 (91.1 : 91.2). BREMEKAMP, C. E. B. **The genus *Praravinia* Korth. (Rubiaceae) in Borneo and Celebes.** *Rec. Trav. bot. néerland.* 37 (1), 1940 (237–78). [E.] O.B.D.

Praravinia is nearly allied to *Urophyllum.* 19 species have been found in the Philippine Islands, 23 in Borneo, and 7 in Celebes. A key is given to the 30 species (22 n. spp.) occurring in Borneo and Celebes.

[968]. 12.26–8. ROULEAU, E. **A necessary transfer in *Populus* (*Turanga*).** *Rhodora* 47 (563), 1945 (362). [Univ. de Montréal.] O.B.D.

(*Celtis*) *ilicifolia* Engler, 1895, has priority over *Populus denhardtiorum* (Engler) Dode, the British East African Poplar.

[969]. 12.26–8 (7 : 8). CRONQUIST, A. **Studies in the Sapotaceae, III. *Dipholis* and *Bumelia.*** *J. Arnold Arbor.* 26 (4), 1945 (435–71). [New York Botanical Garden, New York.]

A revision of these genera including a key to the species of each.

[970]. 12.26–8 (7). CRONQUIST, A. **Studies in the Sapotaceae—IV. The North American species of *Manilkara*.** *Bull. Torrey bot. Cl.* 72 (6), 1945 (550–62). [New York Botanical Garden, New York.] O.B.D.

The final paper on the North American Sapotaceae with a key to the 13 species of *Manilkara*. *Achras* is placed as a synonym.

[971]. 12.6–8 (8). CRONQUIST, A. **Studies in the Sapotaceae—V. The South American species of *Chrysophyllum*.** *Bull. Torrey bot. Cl.* 73 (3), 1946 (286–311). O.B.D.

Thirty South American species of *Chrysophyllum* are recognized, including three new tree species (*C. albipilum*, *C. dusenii*, and *C. lucentifolium*).

[972]. 12.26–8 (95). REEDER, J. R. **Notes on Papuasian Saxifragaceae.** *J. Arnold Arbor.* 27 (3), 1946 (275–88).

[973]. 12.26–8 (69). LEROY, J.-F. Sur l'existence à Madagascar d'un *Aphananthe*, genre d'Ulmacée d'Extrême-Orient et d'Australie orientale. **[On the existence in Madagascar of an *Aphananthe*, a genus of the Ulmaceae of the Far East and Eastern Australia.]** *C.R. Acad. Sci., Paris* 221 (16), 1945 (449–51). [F.] D.S.I.R.

[974]. 12.26–8 : 01.2. MOLDENKE, H. N. **Additional common and vernacular names recorded for members of the Verbenaceae and Avicenniaceae.** *Phytologia* 2 (3), 1944 (65–89). L.S.

Cf. *For. Abstr.* 8 (No. 924).

[975]. 12.26–8 : 01.2. MOLDENKE, H. N. **The recorded common and vernacular names of Verbenaceae and Avicenniaceae arranged according to genera and species.** *Phytologia* 2 (3), 1944 (89–123). L.S.

[976]. 12.26–8 (76.4). MOLDENKE, H. N. **Supplementary notes on the Eriocaulaceae, Avicenniaceae and Verbenaceae of Texas. I.** *Phytologia* 2 (3), 1944 (123–8). L.S.

Supplementary to a discussion of the above families by the same author in Lundell's 'Flora of Texas', Vol. 3 (pt. 1), 1944 (1–87).

13. FOREST ZOOLOGY

[977]. 13.15 (66.68). PAULIAN, R. **Preliminary survey of the West African rain-forest canopy.** *Nature, Lond.* 157 (4,000), 1946 (877). [Muséum d'Histoire Naturelle, Paris.]

During the summer of 1945 a preliminary survey was made of the canopy of the rain forest of the Réserve forestière du Banco near Abidjan, Ivory Coast. An observation platform was built at 150 ft. from the ground, on which the observers spent many days and whole nights. Complete temperature and humidity records for a number of weeks and collections of the fauna (mainly insect) were made. Though a number of species living on or near the ground (particularly the ants *Camponotus maculatus* and *Œcophylla longinodis*) are found up to 140 ft., the majority of the fauna of the canopy are not found in other strata of the forest. An interesting fact is the presence of a rich soil fauna in the thick layer of humus (it may be 6–10 cm. deep) upon the principal branches of the canopy. Collembola, Thysanura, Isopods and Myriopods are numerous. One can trace their path, from the ground upwards, in the small pockets of earth lodged around the roots of epiphytic plants growing along the trunks. It is concluded, pending a complete study of the material, that the West African canopy is a particular habitat, with a distinct fauna and a special ecological climax. It was not possible to define, between the ground and the canopy, a succession of superimposed layers such as Hingston found in British Guiana.

[978]. 13.2 : 13.15 : 45.3 (485). WIBECK, E. Skogen och fåglarna. **[The forest and the birds.]** *Svenska SkogsvFören. Tidskr.* 42 (1), 1944 (34–45). [Sw.]

A lecture, with special reference to Sweden, emphasizing the increasing scarcity, under intensive forestry, of nesting places for hole- and thicket-nesting birds, the consequent reduction in the population of small birds, the usefulness of insectivorous birds and the need for measures to provide them with suitable nesting places.

[979]. 13.2 : 13.15 : 45.3 (485). BROMÉE-SKUNCKE, F. Skogsvården och skogens fåglar, särskilt dess hålbyggare. **[Forestry and forest birds, with special reference to the**

hole-nesting species.] *Svenska Skogsv-Fören. Tidskr.* 44 (3), 1946 (242–59). [Sw.]

Part I of this paper (originally two lectures) argues that 'rational' forestry is not on the whole injurious to the small forest birds, and further, that forestry which does fail to give positive aid to the bird fauna is scarcely rational. The distinction often made between useful and harmful birds is not yet supported by enough evidence to be valid, and the principle to adopt is to aid all birds not definitely proved to be harmful.

Present Swedish practice, with some State regulation of fellings, constitutes a safeguard in itself against too violent changes, often meaning that a bird has to shift only a few hundred yards to find its proper habitat again. The most seriously affected are the hole-builders, for though in the State forests there have long been instructions on the sparing of hollow trees, the general tendency is for such trees to become scarcer, and aid in the form of nesting boxes is thus necessary. The Swedish State Forest Service has also instructions on the leaving of bushes, etc., as low cover and on the laying out of drains to avoid exhausting springs.

The view is urged that rational forestry, by attention to individual ecological units and the hastening of succession, tends to bring about the maximum total production of 'useful' fungi, bacteria, ground flora, birds, mammals and timber, i.e. is of general benefit to all useful forms of life. It follows, and this is supported by the author's experience, that old forest with accumulation of biologically inactive raw humus, e.g. the open quasi-virgin stands of central Swedish nature reserves, will have a poor bird fauna compared with neighbouring tracts under regular management.

A tabular comparison of the nesting sites of 90 common woodland birds of Sweden is made to illustrate the diversity in the needs of the bird fauna, which must be met by diversity in their environment if the fauna is to be maintained.

Part II deals specifically with aid for the hole-building species, based on investigations by the author since 1941 on behalf of the Swedish State Forest administration, which in the past 14 years has had over 46,000 nesting boxes put up. (i) *The environment of nesting boxes* should be such that it affords the bird the means of maintaining itself, and this includes the presence of low cover. Boxes themselves should have some form of cover, should not be exposed to too much rain or sun, and should be placed, *ceteris paribus*, rather low than high.

(ii) *Type of box:* Sheet-metal boxes, though unpopular when first introduced, are competing well with those of wood: they should be of galvanized iron, preferably 0·56 mm. thick, and oil-painted on the outside. Board boxes should be air-dry before nailing, for which galvanized nails should be used. Roundwood boxes should be dried at room temperature for some weeks before bottom and roof are fixed on. The mounting should not be such that it is easily overgrown, strained or broken; it should be visible and detachable when the tree is felled. No perches should be provided, as they only give a foothold for predators.

There should be ventilation holes to reduce moisture, and readily detachable lids or bottoms to facilitate cleaning [cf. (iv) below]. Suitable dimensions (all in cm.) are:—

	For smallest birds	*For starlings, woodpeckers, etc.*
Internal cross-section	9–12	13–15
Diameter of entrance	3–3·5	5
Internal depth from bottom edge of entrance	12–15	12–15
External height from upper edge of entrance to roof	4–5	4–5
Length of eaves	4–5	4–5

The author has constructed rustproof mountings that allow the box to be detached quickly with the aid of special 'tongs'.

(iii) *Siting*: Like perches, branches or stubs near the box will encourage predators. A suitable height is usually 2–3 m., and boxes in woodland should be spaced at least 20 m. apart. Starlings, however, prefer to nest higher and in colonies. No loose matter or lining should be provided: the birds prefer to make their own nest. Boxes should be firmly fastened and slope forwards rather than backwards, to

avoid rain striking in; they should be fixed to smaller rather than larger stems, hardwoods rather than conifers, Spruce rather than Pine. The best time for putting boxes up is late summer to autumn, or early spring before breeding begins.

(iv) *Care of boxes*: Yearly inspections should be made, boxes cleaned of nests, and split or unserviceable boxes removed or mended. Nests harbour fleas, etc., large nests or accumulations of nests increase the number of these (hence large boxes are unsuitable for small birds), and fleas and the like are more prevalent in moist than in dry boxes. The author has begun trials of DDT ('Gesarol') and Neocidol for the insecticidal treatment of boxes.

(v) Notes are included on species that used the boxes in the 5 years of the investigation. Pied flycatcher was the most frequent user throughout, followed by the tits. In one summer, redstart nested as frequently in boxes in Norrland as did tits. Of the 39 true hole-nesters only 17 used the boxes, though several non-hole-nesters were found (as were bees, wasps and hornets, all more frequent in wooden than in metal boxes). Squirrels and pygmy owl used some boxes as larders. Bats occurred three times in roundwood boxes, and might be worth special encouragement. Nuthatch, tree creeper and woodpeckers rarely used the boxes. The last-named, at least in certain areas, often hack the wooden boxes apart and there is evidence that this is done by some great spotted woodpeckers in order to extract and eat young flycatcher or tit broods. This may be prevented by use of metal boxes, possibly also by impregnation of wooden boxes, which is being investigated by the author; but the question how to attract woodpeckers to nest in boxes themselves, remains unsolved.

(vi) Tabulated results are given to show the serviceability and percentages of occupation of metal, wooden and bakelite boxes, so far as reliable figures are available. These may be summarized thus:—

Type	*No. investigated*	*Per cent. unserviceable*	*Per cent. inhabited*	*Per cent. uninhabited*
Metal (1941–5)	2,552	5	70	25
Roundwood (1941–5)	1,658	24	42	34
Board (1941–5)	330	11	23	66
Total wood (1941–5)	1,988	22	39	39
Bakelite (1944–5)	108	9	74	17

These figures include boxes put up by both trained and untrained persons.

[980]. 13.2 : 13.19. MACKENZIE, J. M. D. **Some factors influencing woodland birds.** *Quart. J. For.* 40 (2), 1946 (82–8 + plate).

A review of some of the factors thought to govern the numbers and distribution of birds in commercial woods. Food is and always must be the ultimate limiting factor, but it does not often come into play. Besides territoriality, nest sites are a factor which limits both distribution and numbers in commercial woods but is probably not of importance in amenity woods except perhaps for hole-breeders. Hole-breeding birds will not nest where there are no holes, and birds wanting a thicket or hedge will not nest where there is no undergrowth or an acceptable substitute for it. Song-posts are essential for some birds and govern the size and age of plantations which they will colonize. American observations have shown that cover is an essential, and that a given piece of country can hold a certain number of birds only. Another investigation showed that the holding power or capacity of cover depended very exactly on the amount of edge, that is the transitional zone between two types of vegetation, e.g. forest and cultivation. When a road was made through an area of forest, the birds increased because there was a new edge on each side of the road. Tree species govern both numbers and distribution of certain birds [cf. *For. Abstr.* 7 (1687)]. Very few woods are really pure stands; there are gaps, roads, streams, etc., all providing edges, and it is often found that, in a 'pure' wood, such birds as there are are almost entirely confined for nesting, or feeding, or both, to the 5 or 10 per cent. which is not of the main species.

[981]. 13.2 (43.9). GYÖRFI, J. Adatok a Köszegi-hegység valódi fürkészdarazsféléinek (Hymenoptera. Fam. Ichneumonidae) ismeretéhez. [**Notes on the Ichneumonidae of**

the Köszeg Mts.] *Erdész. Kisérl.* 45 (1/4, 1943–4 (115–26). [Hu.g.e.]

Remarks on the biological rôle of ichneumons, followed by a systematic list of new records (including some species new to Hungary) of ichneumons and their hosts in this region.

[982]. 13.2 : 13.15. GYÖRFI, J. Megfigyelések a fürkészdarazsak nemzöinek táplálkozásáról. **[Observations on the nutrition of imagos of parasitic Hymenoptera.]** *Erdész. Kisérl.* 45 (1/4), 1943–4 (87–114). [Hu.G.f.]

Field observations showed that adult parasitic Hymenoptera, and especially species that parasitize aphids, coccids and the larvae of insects associated with these (e.g. syrphids, coccinellids), have a preference for leaves covered with honeydew. They also feed, particularly the braconids and chalcids, on the lymph of the insects in which they oviposit. Among vegetable foods, the adult Hymenoptera prefer the flowers of umbellifers, especially *Daucus carota* and *Pastinaca sativa*, and those of lucerne and red clover. Györfi found species in lucerne fields whose hosts were woodland species some distance away.

Laboratory experiments in which the insects were offered pure water, sugar solution, diluted or undiluted honey, resin, fruit juice, and pollen of various plants, showed that: (i) Every adult parasitic hymenopteron, however short its life, feeds if it has the opportunity. (ii) The food may be animal or vegetable, liquid or solid. (iii) Some species feed selectively, others not. (iv) Usually no food is taken on the first day after emergence from the pupa. (v) Among artificial foods the diluted honey, most closely resembling the natural food, was usually preferred. (vi) After mating in the case of males and after oviposition in that of females, acts which shorten the adult life, the insects take no more food and soon die. (vii) The duration of adult life is affected by temperature as well as by nutrition. (viii) At lower temperatures starvation can be endured for longer periods.

[983]. 13.2 : 13.15 : 45.3 : 12.26–8 (43.9). GYÖRFI, J. Ökológiai vizsgálatok a Hymenopterák életéből. **[Ecological investigations on the life of the Hymenoptera.]** *Erdész. Kisérl.* 45 (1/4), 1943–4 (1–70). [Hu.G.f.]

Györfi discusses the nature of the biotope and the biocoenosis, and the abiotic and biotic factors (especially weather and man) that upset the natural equilibrium, e.g. the opportunity for the sudden and frequent outbreaks of *Lymantria dispar* in Hungary is provided by weather and the pure plantations of Turkey and Pedunculate Oaks. The parasites, their alternative hosts and the food plants of the latter, are enumerated, and it is pointed out that the alternative hosts of the parasites are insects that live on species of the underwood and ground flora, which are lacking in the pure forests; hence conditions are unfavourable to the parasites and in favourable weather mass outbreaks of *L. dispar* can occur.

An annotated list is given of Hymenoptera observed in western Hungary in 1943 during the author's ecological studies, from which he concludes: (i) That the Hymenoptera prefer sunny places, a fact of importance in regard to the Ichneumonidae, which avoid dense, closed forest. (ii) That for the adult ichneumons it is important that flowering Umbelliferae should be available. (iii) That the presence of ground flora is necessary for a supply of alternative hosts: the richer the flora, the richer is the fauna and the more stable the coenosis.

2. SILVICULTURE

[984]. 2 : 12.25 (44). BALDY, F. Les sapinières de l'Aude, leur traitement, leur produits. **[The Fir stands of Aude, their management and products.]** *Rev. Eaux For.* 79 (8), 1941 (554–72). [F.]

[985]. 2 : 12.25 (44). NOISETTE, M. Le reboisement en Sapin à basse altitude dans les Vosges. **[Reforestation with Fir at low altitudes in the Vosges.]** *Rev. Eaux For.* 79 (9), 1941 (627–37). [F.]

[986]. 2 : 12.25 (44) : 3. MORIZE. Les mélézeins des Hautes-Alpes: leur culture et leurs produits. **[The Larch stands of the department of Hautes-Alpes: their silviculture and products.]** *Rev. Eaux For.* 79 (5), 1941 (319–26). [F.]

Larix decidua is the most widely distributed species in the department of Hautes-Alpes. The Larch stands cover an area of about 12,500 ha. at altitudes between 1,400 and 2,300 m. The Larch appears to be indifferent to the chemical composition of the soil, but does not flourish except in relatively deep, loose, cool soils. Sites with a northern or eastern aspect appear to suit it, but occasional good specimens are found on sites with a southern or western aspect and the lack of extensive stands on such sites may be due to the fact that the best soils are usually cultivated, so that only poor ones are left to the forest. Stands above 2,000 m. are usually stunted and sickly. The growing stock per ha. is about 250 stems of 0·2 m. and over in diameter, with a volume of 90–100 cu.m. Growth is vigorous in youth, slows down at about 130 years, and at 180 years many individuals begin to die. Canker is rare, but every 6 or 9 years the Larch stands suffer from an infestation of *Pyralis*, which generally lasts about 3 years. Most of the stands are managed as fully stocked high forest on a permanent periodic-block system with a rotation of 150–200 years, regeneration being obtained by strip or seeding fellings. In most instances these methods have led to disappointment, and a return has been made in some forests to the older selection system of management, but again without success in obtaining natural regeneration. Suggested remedies are that seeding fellings, of whatever type, should be sufficiently open, that stumps should be grubbed up, and soil cultivated where possible, and failing this, that sheep should be pastured in the clearings to eat down the ground cover. Notes are given on the utilization of Larch wood; it is good for building timbers, floor boards, turnery, cooperage and telegraph poles.

Larch is customarily felled only during the period of dormancy, and if it has to be felled during the vegetative period it is usual to leave the felled trees for several months in the bark and with the top of the crown on, in order to exhaust the sap. [Cf. *For. Abstr.* 8 (No. 1478).]

[987]. 2 : 12.25 (44) : 3 : 4. CARMANTRAND, R. DE. Le Pin d'Alep dans la région méditerranéenne. **[The Aleppo Pine in the Mediterranean region.]** *Rev. Eaux For.* 78 (4–6), 1940 (223–37 + plates). [F.]

A general account of Aleppo Pine (*Pinus halepensis*), its distribution and habit in France, silviculture, utilization and enemies.

[988]. 2 : 12.25 (73) : 12.19 : 3 : 4 : 5 : 6. WAHLENBERG, W. G. **Longleaf Pine: its use, ecology, regeneration, protection, growth, and management.** Charles Lathrop Pack Forestry Foundation, Washington, D.C., and Forest Service, U.S. Department of Agriculture. 1946. pp. xxii + 429 + plate. Price $5 (30*s.*).

This comprehensive monograph renders accessible to the forester, timber grower, research worker and teacher much information, some of it previously unpublished, on the resources, uses, silviculture and management of *Pinus palustris*. Part 1 deals with resources, uses and properties; Part 2 with ecology, including a chapter on the rôle of fire in regeneration of Longleaf Pine; Part 3 with problems of natural and artificial regeneration; Part 4 with protection from fire, insects, diseases, animals and climatic injuries; and Part 5 with management, including chapters on naval-stores operation and growth and yield of Longleaf Pine trees and stands. Each chapter is briefly summarized. Eleven appendices include a glossary, stand tables, diameter and height tables, volume tables, normal growth and yield tables for second-growth Longleaf Pine. There are 74 original text figures, 48 plates, a bibliography of over 600 references, and a subject index.

[989]. 2 : 12.26–8 (44) : 22. PARDÉ, L. Le charme dans les forêts du nord-est de la France. **[The Hornbeam in the forests of North-east France.]** *Rev. Eaux For.* 79 (8), 1941 (547–53). [F.]

The Hornbeam (*Carpinus betulus*) occupies a large place in the forests of North-east France. The writer describes its silvicultural characters and discusses its value and/or danger as a forest species. He concludes that it may be very useful in coppice with standards, provided that it is never allowed to dominate or threaten to dominate a thrifty, well formed Oak. It is to neglect of this rule that the disappearance of the Oak from the forests of North-east France is largely due.

[990]. 2 : 12.26–8 (44). PARDÉ, L. Le hêtre dans les forêts feuillues des plateaux et collines du Nord-Est de la France. **[The**

Beech in the broadleaved forests of the plateaux and hills of North-east France.] *Rev. Eaux For.* 78 (7–9), 1940 (275–88 + plates). [F.]

[991]. 2 : 12.26–8 (44) : 22. COINCY, H. DE. Les chênes dans la région des Landes de Gascogne. **[The Oaks in the Landes of Gascony.]** *Rev. Eaux For.* 79 (6), 1941 (423–6). [F.]

Four species of Oak occur naturally in the Maritime Pine region of Gascony: *Quercus robur, Q. occidentalis, Q. toza, Q. ilex.* Notes are given on their silvicultural characters and systems of management.

[992]. 2 : 12.26–8 (489). G[EETE], E. Dansk ekskogsskötsel. **[Silviculture of Oak in Denmark.]** *Skogen* 33 (11), 1946 (181–2). [Sw.]

Summary of lecture by T. Jagd. Oak (chiefly Pedunculate) occupies 7–8 per cent. of Denmark's forest area. Home supplies of mast are insufficient but mast from the Arnhem district of Holland is imported and gives good results, apparently representing a race constant in form and climatic tolerance. Oak is best on low-lying stiff clays with a shallow water table. Mildew and autumn frost are the chief causes of damage, though in the cold winters following 1940 many older trees developed frost cracks. Sowing is the best method of regeneration and is done as soon as possible in spring on prepared strips. Acorns are sown 5–10 cm. deep and 30 to the running metre (700 kg. per ha. at 300 acorns per kg.). Planting may be difficult in dry springs; where this method is used the plants are put out under a shelterwood which is removed in 3 fellings over 9 years, or else a nurse crop, e.g. Alder, is used. Natural regeneration is sometimes successful, and for this all underwood is removed and harrowing is carried out in a mast year. Thinnings must create space, select for quality and secure good stem distribution. The first thinnings are made every two years, underwood being left for protection. Epicormics are regarded as a sign of disturbed equilibrium, and the remedy is even but heavy thinning to secure steady maximum growth. A suitable rotation is 140–150 years and at this age the increment may be 5 cu.m. per ha. on very valuable dimensions; normal bank interest, however, may be expected up to an age of 200 years. [Cf. *For. Abstr.* 8 (No. 1023).]

[993]. 2 : 12.26–8 : 66 : 12.19.2 (931). HOCKING, G. H., and KENDERDINE, C. A. B. **Silvicultural observations on a central North Island Beech forest.** *N.Z. J. For.* 5 (2), 1945 (90–102).

The Rangataua State Forest of some 20,000 acres lies on the southern slopes of Mt. Ruapehu. Commercial forest ranging from 2,100–3,500 ft. consists predominantly of mature and overmature Red and Silver Beech (*Nothofagus fusca, N. menziesii*) with small areas of Mountain and Black Beech (*N. cliffortioides, N. solandri*). Podocarps form about 1 per cent. of the growing stock. In the lower part of the forest there is a heavy sub-tropical rain-forest undergrowth and ground cover with little Beech regeneration or advance growth. With increasing altitude the undergrowth and ground cover become sparser and the proportion of young Beech increases. The main silvicultural problem is the development of a technique to induce adequate regeneration. There is evidence that undergrowth rather than top canopy is the factor limiting regeneration, and that its destruction in advance of logging will be necessary. Increment borings indicate a rotation of 100 years for Red and Silver Beech sawlogs. *Authors' summary.*

[994]. 2 : 12.26–8. GAUSSEN, H. Le Noyer, arbre forestier. **[The Walnut as a forest tree.]** *Rev. Eaux For.* 84 (6), 1946 (301–14). [F.]

The article reviews the opinions of a number of writers on the practicability of growing the Walnut as a forest tree, and particularly the description by Trofimov of forests of *Juglans fallax* Dode in Turkestan. These forests are characterized by the exceptional abundance of grasses in the ground cover (up to 3 tons dry weight per ha.) and the high humus content of the soils. He suggests a plan for experimental plantings of this species in the south of France. The method suggested is coppice with standards, the understorey to be composed of *Robinia* or Alder. The necessary conditions seem to be a rich soil and a climate characterized by hot summers.

[995]. 2 : 12.26–8 : 60.2. TREYNE, F. *Pterocarya caucasica*, arbre d'avenir à propager. **[*Pterocarya caucasica*, a tree with a future.]** *Rev. hort., Paris* Feb., 1944 (22–3). [F.] *Abstr.* in *Rev. Eaux For.* 82 (6), 1944 (341).

This species should be very useful for planting in wet sites, particularly in derelict areas such as the Sologne, where it does particularly well. Experimental plantings have been made along the banks of the Allier near Villeneuve and at Vichy. Specimens in the arboretum at Balayne, now about 100 years old, are 30–40 m. high. Two-year-old stock is best for planting. Attempts at grafting Walnut scions on to *Pterocarya* stock failed after a promising start.

[996]. 2 : 12.26–8 : 33.8 : 4. **The cultivation of the Cricket Bat Willow.** *Bull. For. Comm., Lond.* No. 17, 1936 (reprinted 1946). pp. 50 + plates.

21. SILVICULTURAL CHARACTERS OF TREE SPECIES

21.0. *Adaptability to the General Environment. Acclimatization*

See also *For. Abstr.* 8 (No. 1095).

[997]. 21.0 (44). PARDÉ, L. Les arbres indigènes et exotiques dans le midi de la France et, plus spécialement, sur notre Côte-d'Azur. [**The native and exotic trees of the South of France, and more especially of the Côte-d'Azur.**] *Rev. Eaux For.* 79 (1; 2), 1941 (41–55; 86–106). [F.]

[998]. 21.0 (44) : 12.25 : 44.3 : 12.21. GUIDAUDEAU, C. Étude sur le pin Weymouth dans les Vosges. [**Study of Weymouth Pine in the Vosges.**] *Rev. Eaux For.* 80 (10, 11), 1942 (457–60; 507–11). [F.]

Pinus strobus was introduced into the Vosges about 1850 and was used principally from 1860 to 1869 for planting moist sites. It has grown well and produces abundant regeneration, but is seriously threatened by the attacks of *Peridermium strobi*.

[999]. 21.0 (66.8) : 12.26–8 : 22.89. La teckeraie du Togo. [**The Teak plantations of Togoland.**] *Rev. int. Prod. colon.* 21 (199), 1946 (62). [F.] Also in *Rev. int. Bois* 13 (105), 1946 (71).

Teak was introduced into Togoland in 1901 by the Germans and by 1914 more than a million had been planted. The French administration has continued to plant Teak and there are now more than 4 million trees. The German plantations had an admixture of other species, but the French have planted Teak pure, which greatly facilitates thinning and has not so far caused outbreaks of insects or fungi, but the lack of protection to the soil resulting from prolonged leaflessness in the dry season, slows down height increment in some areas.

[1000]. 21.0 (71.1) : 12.25. BRITISH COLUMBIA. **Report of the Forest Service: year ended December 31st, 1945.** King's Printer, Victoria, B.C. 1946. pp. 90 + plate.

Exotic trees planted in the Lower Fraser Valley are now 20 years old. Records for 13 species show that *Larix dahurica* is the only species tested there that has exceeded the growth of native Douglas Fir. It has made remarkable growth so far, the average dominant tree being now 43 ft. high and 7 in. d.b.h. Several other conifers have adapted themselves very well. *Sequoia gigantea* has a characteristically large diameter—11 in. d.b.h. —but a height of only 25 ft. At the other extreme, *Fraxinus americana* has only 2 in. d.b.h. for a height of 28 ft. (p. 23).

[1001]. 21.0 (83). [GILMOUR, J. D.] **The exotic forests of Chile.** *B.C. Lumberm.* 30 (5), 1946 (89–90).

In Chile, as in other countries of the Southern Hemisphere, exotic trees do much better than native species. Plantations were started in 1881 and now cover over 50,000 acres and are being regularly increased at a rate of 1,000 acres per year. One-year-old seedlings are planted out at a rate of 1,000 per acre. Species mainly used are *Eucalyptus globulus* and *Pinus radiata*. Production per acre of *P. radiata* is 30–50 cords of thinnings for mine timbers, and a final cut of about 200 trees, of 300 bd. ft. each, at 35 years. *Eucalyptus* has not been much exploited for sawlogs. One stand of *Eucalyptus* 43 years old has 72,000 bd. ft. (89 trees) per acre, and a stand of Pine at 42 years has 103,000 bd. ft. per acre.

[1002]. 21.0 (931). MACKLEY, C. **Man-made forests of New Zealand.** *W. Cst. Lumberm.* 73 (2), 1946 (60–2).

An account of both State-owned and privately owned exotic plantations in New Zealand. *Pinus radiata* is the most commonly planted species. More than 80 per cent. of the exotic plantations are in the so-called pumice areas of the North Island. The pumice soil is free and easy to work at any time of the year, and

planting is done very quickly, one man planting 500 to 1,000 trees per day. The growth of trees in these areas is very rapid: average annual height increment is 4 ft. and diameter increment 1 in. Twenty-year-old Pines average 2 ft. in diameter and 80 ft. in height. This great growth is due to the free soil which allows rapid development of the roots; the plentiful rainfall; the length of the growing season and the warmth during the growing season. The labour cost of planting is now about £3 per acre with 500 trees to the acre. The milled output of plantation-grown *Pinus radiata* in 1943 was 42 million bd. ft. In 20 years' time output should reach 2,000 million bd. ft.

Very straight branchless stems of *Cupressus macrocarpa* were obtained by planting 5 ft. apart. Thinning has to be done about the 8th and 15th years after planting in order to get increased girth. The trees grow particularly well near the sea and appear to thrive on various soils.

[1003]. 21.0 (931) : 12.25 : 23.2 : 56. McKinnon, A. D. **Development of Southern Pines in Auckland Conservancy.** *N.Z. J. For.* 5 (2), 1945 (127–32).

Analysis of some 5,000 acres of plantations of *Pinus caribaea*, *P. echinata*, *P. palustris* and *P. taeda* in Auckland, N.Z. It is concluded that plantings of all Southern Pines, except *P. palustris*, should be confined to well sheltered, lower slopes, generally below the 400-ft. contour. Evidence suggests that *P. palustris* can withstand greater exposure, and establishment up to 700 ft. seems justifiable. The percentage of trees of defective habit in *P. taeda* and *P. echinata* is so high that further plantings of these species should be discontinued until the development of existing stands can be followed through to a greater age. The raising of sturdy nursery stock, necessitating drastic culling in nurseries and careful treatment at all stages from nursery to planting site, is of particular importance for Southern Pine. It is of the greatest importance to keep planting lines opened up so as to reduce early injury to succulent shoots by the abrasive action of crowding scrub growth. Early pruning and thinning of stands are essential.

[1004]. 21.0 (931) : 12.25 : 57.0. Lysaght, J. F. ***Pinus torreyana* at Rotorua.** *N.Z. J. For.* 5 (2), 1945 (145–8).

A small plot of *Pinus torreyana* (Soledad Pine) was established in Rotorua in 1906. In 1944 these trees had an average d.b.h. of 15·75 in. and height of 111 ft., with an estimated merchantable volume per acre of 15,000 cu. ft. This compares favourably with Monterey Pine the fastest growing species in New Zealand, but owing to poor seeding and difficulties in transplanting, it is not likely that this species will be used extensively in afforestation. *Author's summary.*

21.3. *Soil Requirements*

[1005]. 21.3 : 12.19.2 : 11.42.31. Vall, W. B. de. **The correlation of soil pH with distribution of woody plants in the Gainesville area.** *Proc. Fla. Acad. Sci.* 6 (1), 1943 (9–24). [Univ. of Florida.] L.S.

This study was begun in September, 1939, in order to obtain data on soil acidity for Longleaf Pine and Swamp Pine, and was later extended to include other dominant woody plants. All pH determinations were made on the basis of forest types. Some account is given of the method of sampling used and laboratory procedure. The soil sample was taken as a vertical section of the first 6 in. of mineral soil exclusive of duff or litter. The data for each sample as regards the flora were taken by using the location of the sample as a centre and tallying all trees within a radius of 20 ft. and all associated shrubs within a radius of 10 ft. These radii were taken as a conservative estimate of the distance that the tree or shrub would send out lateral feeding roots and within which they would therefore be dependent upon the soil from which the sample was taken. The data were analysed according to forest type, habitat, and species. The habitat analysis was made in order to determine whether a correlation exists between the number of times a species occurred in similar yet separate types and the range of pH values over which the species was found as a major component of the type. Some degree of correlation was observed, but it is pointed out that there are several factors which may be responsible, and only soil pH was taken into account. The largest single group of species studied was the genus *Quercus*. Twelve species were studied, and may be divided into 3 groups as indicators of soil pH. *Q. virginiana* indicates very acid soils, the scrub Oaks indicate moderately acid

soils, and the commercial species, *Q. prinus*, *Q. falcata*, *Q. laurifolia*, indicate slightly acid to slightly alkaline soils.

[1006]. 21.3 : 12.26–8 : 31.0. ARNBORG, T. Om vårtbjörkens och glasbjörkens ståndortskrav. **[On the site preferences of *Betula verrucosa* and *B. pubescens*.]** *Skogen* 33 (10), 1946 (163–5). [Sw.]

B. verrucosa is found chiefly on the drier site types, especially on the dry pasture lands and in Scots Pine forest, and its seedlings on these sites are more numerous and more vigorous than those of *B. pubescens*. The various types of figured wood are mostly derived from *B. verrucosa*, though the most widespread and economically most important types of this species have plain wood.

B. pubescens is characteristic of the moister sites in general, and regenerates on them better than *B. verrucosa*. Its timber is almost always unfigured. First distinguished in Finland, the 'Grey Birch' (*gråbjörk*), which has little stem taper, good natural pruning and straight-grained wood valuable for veneer and skis, is normally a form of *B. pubescens*.

Distinguishing characters of the two species are given (photographs) and it is urged that due account should be taken of their site preferences in cleanings, thinnings, etc.

[1007]. 21.3 : 12.26–8 : 12.19.2 (494). AUDEMARS, A. Les chênaies du VIII^me^ arrondissement forestier zurichois et leur distribution (forêts au nord-est d'Embrach). **[The Oak woods of the 8th Forest District of Zürich and their distribution (forests north-east of Embrach).]** *Schweiz. Z. Forstw.* 97 (6), 1946 (219–23). [F.]

With introductory note by E. Krebs (pp. 217–9). Audemars emphasizes that the decrease of Oak in the forests is due to over-exploitation and the preference of owners for other species. He analyses the frequency, by number and volume, of Oak in high forest and coppice with standards, and in different ownership classes. More Oak exists in coppice with standards than in high forest, and more in public, especially communal, than in corporation forests. As regards site preferences, a study of the distribution of Pedunculate and Sessile Oak in the commune of Embrach (map) showed that though Sessile is the less exacting and may grow in mixture with Pedunculate Oak, their preferences are essentially distinct. Pedunculate prefers compact soils derived from disintegrated *molasse* and Sessile Oak the more permeable glacial river deposits. Orography also plays a part: Sessile Oak generally occupies the upper parts of hills where the soil is comparatively dry and shallow whereas Pedunculate Oak prefers the foot of slopes with more compact, richer and moister soil. Other factors such as exposure and light probably affect distribution, but their influence is obscure. Notes are included on the flora of the respective site types: that of Pedunculate Oak sites is the richer. With knowledge of soil and flora, accurate choice of sites for the two forms should be possible.

[1008]. 21.32 : 12.26–8 : 11.49.2 (57.6). KRUPENIKOV, I. A. Nekotorȳe dannȳe po kal'tsiefil'nosti i soleustoychivosti boyarȳshnika *Crataegus sanguinea* Poll. **[On the calciphily and salt resistance of *Crataegus sanguinea* Poll.]** *Bot. Zh. SSSR* 30 (6), 1945 (265–8). [Russ.e.] O.B.D.

The indigenous *Crataegus sanguinea* is not drought-hardy but is very tolerant of saline conditions and is recommended for planting on wet meadow salt-marsh soils with up to 1 per cent. of SO_4 and up to 0·5 per cent. of Cl, which are common in central and north-western Kazakhstan and for the most part represent barren lands.

22. SILVICULTURAL SYSTEMS. FORMS OF STAND

[1009]. 22 (45) : 60.31 : 07.6. DUNCAN, D. P. **Forest practice at Vallombrosa in Central Italy.** *J. For.* 44 (5), 1946 (347–53). [Kansas State College, Manhattan, Kans.]

The forest of Vallombrosa is used for practical study by the Forestry School of the University of Florence. White Fir (*Abies alba*) is managed on a 100-year rotation in even-aged pure stands, formed from stock raised at local nurseries. The management plan provides that no area shall be cut until adjacent stands are at least 25 years old; the direction of the cutting sequence is against the prevailing wind. Tables are given showing volume per acre in fully stocked stands of White Fir at different ages, and expenses and income per acre in White Fir forests in Tuscany.

Chestnut coppice is managed on an 18-year rotation, but some of the best sprouts are held

over to 36 years for telegraph poles or other special uses. A table shows height and normal volume per acre of Chestnut coppice at different ages.

Beech is now mostly on a selection coppice system with an 8-year cutting cycle. Layering is successfully used in order to get new stumps. Matured sprouts are cut at 3·5 to 4·5 in. diam. Also, 50 per cent. of the sprouts between 2·25 and 3·25 in. in diameter, and 20 per cent. of sprouts 1–2 in. are removed at each cutting. Selection of the sprouts to be removed is made on each stump in order to maintain sprouting vigour, which is normally rather low in this species. The Beech, when cut, is converted into charcoal on the site. The selection high forest of Beech has not proved very satisfactory because of the difficulty in obtaining good reproduction. The present plan aims at converting it into mixed forest of Fir and Beech by planting Fir following natural reproduction by Beech. The evidence available where the Fir and Beech types meet indicates that natural reproduction of both species may be expected in mixture, whereas natural reproduction from pure stands of Fir is impossible because Vallombrosa lies near the southern margin of its natural range.

Notes are given on the nursery and arboretum and experimental plots. Douglas Fir shows great promise. At Vallombrosa it seems to be free of attack by *Adelopus gaeumanni* and *Rhabdocline pseudotsugae*, both of which are serious pests of this species in Switzerland. Thinning, pruning, and provenance experiments are being conducted with White Fir. Experimental grafts of *Castanea sativa* upon the fungus-resistant roots of *C. crenata* have not proved very successful, because *C. sativa* grows much more rapidly than *C. crenata*.

[1010]. 22 (77.4 : 77.5) : 60.31. **Forest practices for Wisconsin and Upper Michigan.** *J. For.* 44 (5), 1946 (335–9).

Report of a Society of American Foresters Committee on cutting practices, recommending standards for protecting and cutting the major forest types in Wisconsin and Upper Michigan.

[1011]. 22 (78.6 : 78.3) : 12.25 : 60.31.2. **Forest practice rules for Montana—South Dakota applying to Idaho White Pine, Ponderosa Pine and associated species on industrial forest lands.** Western Pine Association, Portland, Oregon. 1945. pp. 32.

Also the corresponding pamphlets, all of 1945, for Idaho White and Ponderosa Pines with associates in Idaho (pp. 31) and Washington (pp. 32); Ponderosa and Sugar Pines with associates in California (pp. 36) and Oregon (pp. 31); and Ponderosa Pine with associates in Arizona and New Mexico (pp. 30).

22.1. *High Forest Forms*

[1012]. 22.1 (43.1–5) : 09.1. Evers. Welche Folgen hatte der Übergang von der Femelwirtschaft zum Schlagweishauen im württembergischen Hochschwarzwald? [**The results of conversion from selective felling to felling by coupes in the high Black Forest of Württemberg.**] *Allg. Forst- u. Jagdztg.* 116 (12), 1940 (293–319). [G.]

Evers rebuts Dannecker's contention that abandonment of selective felling in this region during the 19th century has led to deterioration of the forests. Records show that the quasi-virgin forests of the upper Murgtal had been so ruthlessly exploited by the end of the 18th century that there was no other course but to abandon selective felling. Neither have valuable species disappeared, nor has the yield demonstrably suffered as a result of conversion to systems of felling by coupes.

[1013]. 22.12 : 01.2. Prasad, J. **Seeding felling.** *Indian For.* 72 (3), 1946 (128).

Seeding felling involves the removal, in a good seed year, of all trees not required afterwards for shelter or for the further production of seed. The cutting can be done shortly before, during or after the fall of the seed. All subsequent openings of the canopy in accordance with the requirements of the crop (including the final fellings) are classed as secondary fellings. [Cf. *For. Abstr.* 7 (No. 1712).]

[1014]. 22.13 : 22.14.1 (494). Rüedi, K. Synthese von Femelschlag- und Plenterverfahren? [**Synthesis of the irregular shelterwood and selection systems?**] *Schweiz. Z. Forstw.* 97 (5), 1946 (194–209). [G.g.f.]

Only two of the silvicultural systems—the irregular shelterwood system (Swiss *Femelschlag*) and the selection system proper—now enjoy much credit in Swiss forestry, and even these show considerable convergence, since in their modern forms (*a*) the former tends to work with more numerous and smaller regeneration groups and to retain veteran

standards, while (*b*) the latter places less insistence upon storeyed structure in order to accommodate light-demanders. In the irregular shelterwood system it is possible to distinguish forms with or without a definite direction of the fellings in space: in the last, and only in the last category, is it not only possible but probable that fusion will occur with the selection system, giving rise to an intermediate between the systems as formerly and more strictly understood, with modifications one way or the other to suit local conditions. Irregular shelterwood fellings having a definite direction are quite distinct from the strip systems. The actual direction selected will be based primarily on limits for extraction and bound up with the development of a complete network of forest roads.

Though making no pretence to judge (in the absence of data that can only accumulate slowly in the future and must include timber quality as an important consideration) between the irregular shelterwood system with directed fellings and the intermediate irregular shelterwood/selection system, Rüedi personally favours the former. In conclusion, he points out that though the study of virgin forest would undoubtedly give valuable indications on silvicultural treatment, (*a*) such forest is practically lacking in Switzerland, and (*b*) not imitation of virgin forest, but cultivation and production are the forester's aim; hence questions such as those of natural pruning, the extraction of long logs, and reduction of felling and skidding damage, will play the chief part, and the forester's task is to compromise between economic demands and those of the natural forest.

[1015]. 22.13 : 22.14.1 (494). LEIBUNDGUT, H. Femelschlag und Plenterung. [**The irregular shelterwood and group systems and the selection system.**] *Schweiz. Z. Forstw.* 97 (7), 1946 (306–17). [G.f.]

In reply to Rüedi [see preceding abstract] Leibundgut clarifies the difference in principle between *Femelschlag* (*coupe progressives, avec régénération lente en groupes et bouquets*; irregular shelterwood and group systems—the modern Swiss variant being an irregular shelterwood system in Troup's classification) and *Plenterung* (*jardinage*; selection system proper). Despite superficial resemblances between the two in modern Swiss practice, there are fundamental differences in that: (i) in the selection system all human intervention, with the exception of care of the regeneration and cleanings, are fused into one operation—the selection felling, whereas in the irregular shelterwood system care of regeneration, cleanings, thinnings, preparatory and regeneration fellings, are performed in succession; (ii) the selection system abandons spatial arrangement of operations, whereas in the irregular shelterwood system distinction is necessary between regenerated, unregenerated areas, etc.; (iii) in the selection system a state of equilibrium is aimed at even over comparatively small areas (say 3–4 ha.), whereas perceptible variations in growing stock and stand structure, more or less evident according to species, regeneration period and site, are inherent to treatment under the irregular shelterwood system. The criterion of whether a forest is treated as selection forest or under the irregular shelterwood system is not the form of the individual stand but the structure of the whole forest.

The advantages of the selection system over the irregular shelterwood are: (i) The unlimited possibility of turning to account all valuable individual growth. (ii) The continuity of operations and the production of high value and volume yields even on a small area. (iii) The maximum exercise of protective effects. (iv) The maximum resistance to damage by atmospheric agencies. Its disadvantages are: (i) Selection and measures for improvement are more difficult to apply. (ii) It is difficult to obtain regeneration of light-demanders. (iii) Felling and extraction are more complicated. Species, site and conditions for harvesting will decide the balance of these factors: thus in the mountain forest of the mixed Silver Fir/Spruce/Beech area, the selection system will usually have the greater advantage, whereas light-demanders and broad-leaved forest will be better suited by treatment as regular high forest with successive fellings and regeneration in groups.

The intention of the present analysis is not to encourage the rigid application of one principle or the other, which would be a grave disservice, but to clarify the ends to which operations are directed. The dilemma: selection system or irregular shelterwood, will be solved according as the combination of all intervention into one operation is adopted or rejected.

[1016]. 22.14. Roth, G. Linienplenterung und Linienplenterschlag. **[The 'line selection system' and 'line selection fellings'.** *Intersylva* 1, 1940–1 (32–41). [G.e.f.it.span.]

Cf. *For. Abstr.* 3 (120).

[1017]. 22.14.2 (71.4). Long, H. D., and Silversides, C. R. **Selective cutting on the Windsor Mills freehold limits of the Canada Paper Company.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 839 (F–2), 1946. pp.3. P.R.

Selection is based, not only on diameter, but on spacing, the condition of the tree, its rate of growth and suitability, the length of the cutting cycle, etc. The condition of areas cut over ten years ago illustrates the benefits of the method. The stands are well stocked, the trees showed an increase in diameter growth compared with uncut stands, and the invasion of undesirable species and dense shrub and herb vegetation is reduced.

[1018]. 22.14.2 : 12.25 : 56 : 24.3. Pearson, G. A. **Ponderosa Pine in the second cutting cycle.** *J. For.* 44 (5), 1946 (354–68).

An area of 480 acres of Ponderosa Pine in northern Arizona was logged in 1909 under the old group-selection method, and a second time in 1939 under three methods: (1) favouring dominants; (2) favouring subordinates; (3) salvage [cf. *For. Abstr.* 3 (177)]. Differentiation between the three methods was not sharp. Salvage was necessarily the principal factor in all three methods. The plot was remeasured in 1944. Net annual increment per acre had declined from 115 bd. ft. in the second 5-year period to 52 bd. ft. in the sixth. According to the 20-year trend before the second cutting, it would have declined further to about 40 bd. ft. in 1944, but in fact it rose to 67, notwithstanding a 50-per-cent. reduction in the volume of growing stock. Analysis of trends before and after the second cutting indicates that if the second cut had been made 10 years earlier, net increment to-day would be at least 50-per-cent. higher than it is. Method 2 (favouring subordinates) has demonstrated the practicability of transferring wood increment from inferior boles to good boles. A good bole and ample spacing are of far greater importance than a large symmetrical crown. The principle of favouring subordinates has great merit in both the first and second cuttings, but it must not be applied too literally; good dominants should not be sacrificed to poor subordinates and enough relatively large trees must be left to provide for the next cut.

[1019]. 22.14.2 : 12.25 : 24 : 65 : 66 : 56. Pearson, G. A. **Calculating the growth of Ponderosa Pine forests.** *Rev.* in *J. For.* 44 (6), 1946 (444–5).

A review of P. A. Briegleb's monograph 'Calculating the Growth of Ponderosa Pine', a sequel to his 'Growth of Ponderosa Pine by Keen Tree Class' [see *For. Abstr.* 8 (No. 752), 5 (p. 206)]. In the opinion of the reviewer the whole conception of 'maturity selection' based on 'age and vigour' growth tables is unsound as applied to cut-over stands. Keen's age and vigour classes, based on the assumption that leaf area is the major criterion of growth capacity, in effect favour wolf trees at the expense of the normal tree. On cut-over areas the normal C trees which have been released are often the fastest growers and the best types for sawlogs. The best way to grow sawtimber is to maintain dense stocking in the younger generation until natural pruning comes into play, then open up gradually to encourage diameter growth. In Ponderosa Pine many-aged stands it should be possible to begin taking out rough dominants at an age of 75–100 years, and subsequent cuttings should continue at intervals of 20 years. In this way, groups will be kept growing so that by the time they reach age class III they will not be unduly subject to windthrow or bark beetle. The crowns will be uniformly in class C or the lower grades of class B, and the spacing will be wide enough to encourage reproduction. Briegleb deserves credit for his ingenuity in evolving equations for converting growth in virgin stands into growth in cut-over stands, but in view of the relative ease of obtaining data from cut-over stands directly, the use of his methods seems pointless.

22.2. *Coppice Forest*

[1020]. 22.21 (44). Loriol, de. Les taillis sous futaies de la plaine de la Saône. **[Coppice with standards in the Saône valley.]** *Rev. Eaux For.* 79 (1), 1941 (11–26). [F.]

[1021]. 22.22 : 43.3. Keetch, J. J. **Sprout development on once-burned and repeatedly-burned areas in the Southern Appalachians.** *Tech. Note Appal. For. Exp. Sta.* No. 59, 1944. pp. 3.

Sprouting capacity was measured on a series of plots in a young sprout hardwood stand which had originated after a forest fire that occurred about 25 years before the start of the study. Sprouts on the once-burned area totalled more than 2,900 per acre 8 years after burning, with an average height of 10·4 ft. for the tallest sprout in each clump. Sprouting capacity was not reduced by 3 successive fires. Sprouting activity increased with parent-tree diameter up to 5 in. d.b.h., and decreased beyond 6 in. d.b.h.

23. FORMATION OF STANDS

[1022]. 23 : 12.26–8 : 12.11.3. ROTH, C. Gedanken zur Schwarzerlennachzucht. [**Notes on the regeneration of Common Alder.**] *Schweiz. Z. Forstw.* 97 (8/9), 1946 (399–404). [G.f.]

Like Oak, *Alnus glutinosa* has decreased in Switzerland owing to the introduction of conifers on hardwood sites. Natural regeneration is also rare and the younger age classes usually lacking. Roth's observations suggest that the essentials for natural regeneration are plenty of light and the absence of competition from ground vegetation. Canopy should therefore be opened vigorously at the time of seedfall to allow seedlings to become established on ground free of other vegetation. Artificial flooding, simulating natural flooding so far as possible, should also give favourable conditions by eliminating ground cover and providing a mud layer suitable for germination.

As regards artificial regeneration it is urged that seed should be collected only from older trees in natural stands, since it is believed that stock planted in Switzerland during the past 20 years represents the same inferior Belgian race as that investigated by Münch in Germany.

[1023]. 23 : 12.26–8 : 24 (494). FISCHER, F. Nachzucht und Erziehung der Eiche im bernischen Bucheggberg. [**Propagation and rearing of Oak in the Bernese Bucheggberg.**] *Mitt. schweiz. Anst. forstl. Versuchsw.* 23 (2), 1944 (375–470 + plates). [G.g.f.]

From these investigations it is concluded that (i) artificial regeneration of Oak is preferable to natural regeneration in Bucheggberg and probably also throughout most of the Swiss forests. Apart from its economic advantages, artificial regeneration allows a certain amount of elasticity. (ii) Soil factors determine the method to be used; sowing is generally better than planting from the aspect or costs and expected success. (iii) The initial density of the recruitment ought to be not less than 50,000 to 60,000 plants per ha. to ensure successful regeneration and subsequent cleaning of thickets. (iv) The number of stems diminishes very rapidly in a few years and this fact emphasizes the importance of early and repeated cleaning and thinning. (v) Appreciation of the transpositions and alterations which take place in the constitution and quality of the stand forms the solid theoretical basis of improvement measures. (vi) The success of later thinnings depends less on the number of stems than on the existence of a well ordered understorey; it ought to reach the height of the clean bole of the Oaks by the time of the first thinning, i.e. should be formed as soon as possible. (vii) Underplanting with conifers has given the best results but it is doubtful if broadleaved species should be excluded permanently from the underwood. (viii) The best Oak sites in Switzerland are in no way inferior to those classed as best quality in German yield tables. (ix) The regeneration of Oak acts favourably towards the economic success of forest operations provided the cultural procedure is rationally chosen. [Cf. *For. Abstr.* 7 (Nos. 1716, 1725–7); 8 (No. 992).]

23.1. *Natural Regeneration*

[1024]. 23.1 : 12.25 (931). MCKINNON, A. D. **Natural regeneration of Kauri.** *N.Z. J. For.* 5 (2), 1945 (133–7).

In order to study the establishment of Kauri (*Agathis australis*) by natural seeding, a 0·5-acre experimental plot was demarcated under a typical stand of mature Kauri. Viable seed was produced by seed trees on and adjoining the plot, sufficient in quantity to enable some 18,000 to 25,000 seedlings per acre to germinate from a single seedfall. Clearing of the forest floor enables such seed to reach the soil and germinate. Owing to the depth of the litter layer and the fibrous humus layer of the soil, heavy mortality occurs amongst seedlings during prolonged dry weather, the roots not having penetrated to the A_1 horizon of the soil. Second growth, particularly *Blechnum fraseri*, is aggressive, and seedlings benefit by its removal 4 years after initial clearing. Root competition is keen, and

Kauri seedlings on a quadrat whose boundaries were trenched to below the general root level showed a significant improvement in size and vigour compared with an adjoining control quadrat. Further quadrats are to be trenched for confirmation of this point.

[1025]. 23.1 : 12.25 (71). LONG, H. D. **Spruce reproduction.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 774 (F–2), 1945. pp. 3.

The author suggests that Spruce reproduction in Canada can be encouraged only by two general methods: (1) exposing the mineral soil, which would involve some expense and probably necessitate artificial sowing; (2) maintaining the deep moist humus seedbed of mature Spruce stands by selective cutting methods. The rotting logs and mossy floor of a mature stand provide an excellent seedbed for Spruce and enable it to compete successfully with Balsam Fir which, on cut-over sites, usually replaces Spruce.

[1026]. 23.1 : 12.25 (71.4 : 71.5). LONG, H. D. **Observations on Spruce regeneration.** *Pulp Paper Mag. Can.* 47 (4), 1946 (67–8).

It seems apparent that mature Spruce stands of age class 80–100 years or more may be safely clear cut and depended upon to reproduce satisfactorily to Spruce, at least in Northern Quebec. In immature stands selection cutting should be practised, as clear cutting will probably result in a growth of Fir and hardwoods. Cutting on a short rotation, say every 10 years, and skidding the timber in order to scratch up the raw humus and expose the moist humus and mineral soil, should be of great help in obtaining Spruce regeneration.

[1027]. 23.1 : 12.25 : 24.3. MORRIS, W. M. **Ponderosa Pine reproduction taking over area from which Lodgepole removed.** *For. Res. Note Pacif. Nthwest. For. Exp. Sta.* No. 33, 1945 (14–15).

In order to investigate the possibility of converting an area of Lodgepole Pine with suppressed Ponderosa Pine understorey to Ponderosa Pine, an area of 1 acre was completely cleared of the Lodgepole overstorey and reproduction, and the Ponderosa Pine reproduction was left unmolested. An adjacent 1-acre control plot was also established. The growth of the terminals on the treated plot did not increase appreciably until about 8 years after the Lodgepole was removed, when the difference in current leader growth became striking, particularly in the larger individuals, average growth being 0·2 ft. and 0·05 respectively. It would appear from this experiment that Ponderosa Pine seedlings and small saplings will respond to release, even after decades of suppression, though the response is slow in coming.

[1028]. 23.1 : 12.25 : 12.11.21. ZEHNGRAFF, P. J. **Effective seeding range of Red Pine.** *Tech. Note Lake St. For. Exp. Sta.* No. 228, 1945. p. 1.

A survey was made to determine the effective seeding range of seed trees and thus the number needed per acre to secure full restocking. It was found that the effectiveness of the seed trees decreased rapidly beyond 40 ft. For full stocking the spacing of the seed trees would have to be 60–80 ft., or 20–30 seed trees per acre in mature stands with full seed-bearing capacity. This number would have to be increased in young stands.

[1029]. 23.1 : 12.25 (494). TANNER, H. Über das Problem der Föhrenverjüngung. **[On the problem of Scots Pine regeneration.]** *Schweiz. Z. Forstw.* 97 (4), 1946 (129–45). [G.f.]

From personal experience, illustrated by notes on stands in the Rhine valley from the Liechtenstein border to the north of the Canton of Zürich, and from a review of literature, Tanner concludes that, where the stands are of good race, Scots Pine should be retained in mixture, preferably in large groups of 100–1,000 trees each, with hardwoods. Mixture by isolated trees would seldom or never be suitable. For successful germination and survival an open seedbed free from weeds, and especially from grass sod, is necessary, and where the latter is present it must be pared off to expose the mineral soil. On taking up a group for regeneration, the canopy must be severely opened and removed entirely after the appearance of regeneration. Well distributed gaps of 10–30 ares will be necessary. Pine regeneration is very susceptible to felling damage and no fellings should be made once regeneration is established. Competition from other species must be controlled by adequate and continued tending.

[1030]. 23.1 : 12.26–8 : 12.19 (41.1–4). FENTON, E. W. **Presidential address: some factors affecting the natural regeneration of Oak in certain parts of south-east Scotland.** *Trans. bot. Soc. Edinb.* 34 (2), 1945 (213–32). O.B.D.

Comparative studies of plant species associated with Oak in three forests indicate that the exact nature of the vegetation type may not be so important as shade and moisture conditions. Grazing, fire, damage by rodents and disease, and possibly soil acidity, have been contributory factors in preventing successful regeneration of Oak in Scotland.

[1031]. 23.1 : 65.7. MUNGER, T. T. **Stocked quadrats vs. number of trees as a basis for classifying reforesting land.** *For. Res. Note Pacif. Nthwest. For. Exp. Sta.* No. 33, 1945 (2–7).

23.2. *Artificial Regeneration*

[1032]. 23.2 (44). POURTET, J. Les repeuplements artificiels. [**Artificial regeneration.**] École nationale des Eaux et Forêts, 14 Rue Girardet, Nancy. 1946. pp. 184 + charts. [F.]

A practical manual designed for the use of officers of the Forest administration and private landowners interested in reforestation. The methods recommended are simple, and are the result of field experiments by the author. The book contains sections on the following subjects: seeds, direct sowing, plantations, silvicultural methods for the principal species used in reforestation, introduction of species into existing forests, methods of reforesting various soil types, planting canal banks, shelterbelts, etc.

[1033]. 23.2 (79.5 : 79.7). KUMMEL, J. F., RINDT, C. A., and MUNGER, T. T. **Forest planting in the Douglas-fir region.** U.S. Forest Service, Portland, Oregon. 1944. pp. iv + 154 + plates.

This bulletin describes the various techniques of nursery practice and artificial reforestation that have been found practicable in the Douglas Fir region of western Washington and Oregon. It is intended for the use of seed collectors, nurserymen, planting foremen and foresters who are engaged in the management of forest lands. It deals primarily with Douglas Fir but makes some mention of the associated species of the area covered.

23.22. Preparatory Work. Auxiliary Measures

[1034]. 23.22 : 12.25 : 23.13. FOWELLS, H. A. **Site preparation as an aid to Sugar Pine regeneration.** *For. Res. Note Calif. For. & Range Exp. Sta.* No. 41, 1944. pp. 4.

Brush cover of Bear Clover (*Chamaebatia foliolosa*) and high brush (mainly *Ceanothus cordulatus*) was removed mechanically from 37 unstocked areas in cut-over stands, in anticipation of a good Sugar Pine (*Pinus lambertiana*) seed crop. In spite of a good seedfall, natural reproduction was a failure, probably because of rodent depredations. After 3 years, seed spotting was less effective than planting in areas cleared of Bear Clover, but more effective than planting in areas cleared of high brush. A fair percentage of Sugar Pine from seed and planting survived and grew well through the third season, indicating possibilities of successful establishment before brush regains control. *From author's summary.*

[1035]. 23.22 : 12.25 : 21.3. LEBARRON, R. K. **Mineral soil is favorable seedbed for Spruce and Fir.** *Tech. Note Lake St. For. Exp. Sta.* No. 237, 1945. p. 1.

The following table shows the number of seedlings established per 100 seeds, five years after sowing.

Soil surface	*Balsam Fir*	*Black Spruce*	*White Spruce*	*All*
		clear-cut area		
Mineral	25·8	29·5	26·8	27·4
Duff	2·5	0·2	0·2	1·0
Slash-covered duff	1·5	0·2	0·5	0·7
		40-per-cent. tree cover		
Mineral	37·2	18·0	42·5	32·6
Duff	1·2	0	0	0·4
Slash-covered duff	1·0	0	0	0·3

In addition to the general and striking superiority of reproduction on mineral soil, some significant secondary reactions were observed. Among these are the greater success of Balsam Fir, compared with the Spruces on duff, and the relatively poor response of Black Spruce on mineral soil under tree cover.

[1036]. 23.22 : 21.3. STOECKELER, J. H. **Nutrients in duff and humus layers increase growth of forest plantations.** *Tech. Note Lake St. For. Exp. Sta.* No. 226, 1945. p. 1.

Experiments with Red Pine and Black Spruce showed 50 per cent. greater height growth at the end of 2 and 3 years after planting on disked soils than in furrows [cf. *For. Abstr.* 8 (No. 212)]. A chemical analysis of the surface layers on 5 different Aspen stands in Wisconsin showed that the duff and humus layers had respectively 46 and 24 times as much organic matter, 27 and 15 times as much nitrogen, 23 and 15 times as much available potash and 5 and 3 times as much available phosphorus as the A_2 layer.

[1037]. 23.22.2 (54). SWEET, J. M. **Formation of fuel plantations with *kumri* in dry areas.** *Indian For.* 72 (5), 1946 (210–1 + plates).

In the first year of *kumri* cultivation the crop will generally not do more than cover the expense of ploughing, sowing and reaping. In the second year ploughing is hampered by the lines of trees. As the prospects of getting good results from agricultural and forest crops alike are much brighter after 2 or 3 years of ploughing and cultivation, the author recommends that *kumridars* should be allowed 2 or preferably 3 years of unrestricted use of the land before sowing trees.

23.23. Sowings

[1038]. 23.23 : 12.25 : 12.26–8. HOLTEN, N. E. Saaningsforsøg i Planteskole. [**Sowing experiments in a nursery.**] *Dansk Skovforen. Tidsskr.* 31 (4), 1946 (143–56). [Dan.]

Experiments were made at a nursery in Farum District, Denmark, on:—

(i) *Pre-soaking* of Norway Spruce and F_2 European × Japanese Larch seed for various periods (3 hours to 12 days) in pure water and in HCl solutions (pH 0·0, 3·7, and 5·8), with a control series of untreated seed. The highest plant percents were obtained (in all series except that with HCl at pH 0·0, which was injurious even in the shortest treatment) with treatment for about 24 hours, that with HCl at pH 5·8 being the most and that with pure water (pH 7·5) the next most effective. The differences between treatments and between treated and untreated material were smaller in Larch than in Spruce, and seed of the former appeared to be less injured by high concentrations of HCl. No difference in height was observed in the plants of different series, but germination was quicker in the treated lots.

(ii) *Depth of sowing*: (*a*) *Norway Spruce* gave the best plant percents when sown 15–20 mm. deep. It is believed that results for a series sown 10 mm. deep would have been much the same if damage, probably by mice, had not occurred. Sowings at 30 and 40 cm. deep were definitely inferior. (*b*) *Hybrid Larch* [as in (i)] was best when sown 15 mm. deep, and increasingly poor in deeper sowings. (*c*) *Ash* gave the best plant percent when sown in a furrow 2–4 cm. deep, with a rapid decline for the deeper sowings. (*d*) *Oak* was best in a furrow 5 cm. deep, but was decidedly less sensitive than Ash as regards depth of sowing, so that for the conditions in question 3–7 cm. may be regarded as a suitable depth.

(iii) *Treading of the seedbed*: In this series only Oak was tried (*a*) with treading immediately after sowing, the furrows then being filled with loose earth; (*b*) trodden after covering the seed; (*c*) untrodden. Treatments (*a*) and (*b*) gave much the same results, but the untrodden series (*c*) was inferior, particularly in the shallower sowings.

A caution is added that the results of such experiments cannot be applied directly to other localities where conditions are different.

23.23.1 *Seed Procurement, Treatment, and Testing*

[1039]. 23.23.1 (485) : 81. Samordning av landets skogsfrö- och plantförsörjning. [**Coordination of Sweden's forest seed and plant supplies.**] *Från skogsvårdsstyrelsernas arbetsfält* 1946 (53–6)—*Suppl.* to *Svenska SkogsvFören. Tidskr.* 44 (2), 1946. [Sw.]

After discussion with State and private bodies concerned with forestry, the Association of County Forestry Boards in Sweden [*Föreningen Sveriges skogsvårdsstyrelser*] worked out the

following agreed programme, based on the original report of the board of enquiry on seed and planting stock of the County Foresters' Association [see *For. Abstr.* 7 (No. 1722)] and a conference of 14th June, 1945:—

(i) Each county to set up a Seed Board (*frörad*), if necessary, to secure co-operation between different groups of forest owners in the organizing of county seed and plant supplies. The composition of the board, which is to be elected at a conference called by the County Forester, to be reported to all the central and local bodies concerned. Where no board is appointed, the County Forester will exercise the same functions in collaboration with the various groups of owners. The task of the boards is to establish a plan for supplies; co-ordinate cone collection, seed extraction and plant supplies, and seek to achieve agreement on prices; secure good distribution of supplies; promote inventories of individual trees and stands suitable for seed harvesting; and exercise any other functions likely to improve seed and plant supplies within the county. So far as research organizations are able to provide information on the establishment of seed plantations or other effective measures, the Seed Boards are to consult with such organizations and to endeavour to bring these measures into effect.

(ii) Sweden is divided into 8 seed-supply regions, in each of which co-operation is normally to be arranged by a Liaison Committee (*samarbetskommitté*) made up from the County Foresters of the region. In counties which constitute a seed-supply region by themselves, the Seed Board will assume the necessary duties. The Liaison Committees may call Seed Boards to a conference if questions of regional importance arise, and are to report their proceedings and decisions, if necessary, to the central authorities and organizations. The latter have the responsibility of summoning representatives of the Seed Boards for discussion of wider problems.

(iii) The following classification of forest seed is to be employed until further notice: *Élite seed* is that from registered élite trees selected according to a type scheme prepared by the Royal Forestry Board. *Extra prime* seed is that from first-class stands ('plus' stands) from which the worse trees have been removed. *Prime seed* is that from stands of type class I and from stands of classes II and III with avoidance of coarse-branched or slow-growing trees. *Standard seed* is ungraded seed from stands of type classes II and III ('normal' areas).

(iv) It is expected that funds will become available in the form of public loans to be used in the establishment of seed extractories, nurseries, and for large-scale purchases of cones, etc. Efforts are also to be made for more intensive research on artificial regeneration methods and for more speedy application in practice of the results of such work.

Seed Boards have already been set up in 12 Swedish counties and in 7 more counties the County Forester is acting in place of such boards.

[1040]. 23.23.12 : 12.26–8. PRASAD, J. **Best time for the collection of seed of *Terminalia chebula*.** *Indian For.* 72 (4), 1946 (159–61).

Experiments carried out between 1932 and 1943 (inclusive) indicate that the first fortnight of January is the best period for the collection of the seed of *Terminalia chebula*. There appears to be a correlation between high tannin content and optimal germinative capacity in the case of this species since the best myrobalan is also collected in the month of January.

[1041]. 23.23.15. Aufbewahren überliegender Samen. Conservation des graines qui ne germent que le second printemps après la récolte. **[Storage of seeds that germinate only in the second spring after collection.]** *Merkblatt der Beratungsstelle für Waldsamenbeschaffung* (*Mémorandum de l'Office de renseignements et conseils pour l'obtention de graines forestières*). No. 3, 1946, pp. [2]. [G.F.] *Suppl.* to *Schweiz. Z. Forstw.* 97 (5–7), 1946.

Brief instructions (with diagram) for the construction of a stratifying pit, and on the stratification of seeds such as those of Ash, Hornbeam, Large-leaved Lime, Maples, Cembran Pine, etc.

[1042]. 23.23.15 : 12.25. CHADWICK, L. C. **Seeds of Red Cedar.** *Amer. Nurserym.* 83 (9), 1946 (10).

The factors responsible for delayed germination of Eastern Red Cedar (*Juniperus virginiana*) seed are the waxy coat and a resting condition of the embryo. The waxy coat can be removed by soaking for several hours in alcohol, or by pouring warm water over the seeds and bringing to the boil, repeating the

operation twice. In order to overcome the resting condition of the embryo, seed should be stratified from about the middle of December to the middle of March, and then sown in well-prepared seedbeds of sandy soil.

[1043]. 23.23.15 : 12.26–8. NAMBIAR, K. K. **A novel method of improving the germination of *Prosopis juliflora* seeds.** *Indian For.* 72 (4), 1946 (193–5). *Repr.* from *Madras agric. J.* 32 (8–10), 1944 (203–6).

Poor germination in *Prosopis juliflora* seeds is due in part to the occurrence of 'hard' or impermeable seeds. In the samples tested, over 40 per cent. failed to absorb water, but when shaken in a metal or glass container for about 15 minutes at the rate of twice per second, seeds so treated gave over 95 per cent. germination. Abrading the seeds by pounding them with sand was also found to be a successful, but less easy, method. *Author's summary.*

[1044]. 23.23.15 : 12.26–8. MIROV, N. T. **Storage and germination of California Cork-oak acorns.** *For. Res. Note Calif. For. & Range Exp. Sta.* No. 36, 1943. pp. 18.

This report covers the first year of experimental work on germination and storage of Cork Oak acorns. Storage at room temperature is not recommended. Viability can be maintained in cold storage (32°–40° F.) for 10 weeks if the acorns are packed in large burlap sacks, or for 10 months, possibly longer, if they are mixed with dry sand in airtight 5-gallon tins. Stratification in moist peat is not advisable.

The effect of growth-inhibiting substances on germination and development of Cork Oak acorns was studied. The experiments seem to indicate that treatment with naphthaleneacetic acid and its derivatives for a short time might retard the germination of Cork Oak acorns. Further experiments are needed on this point. *From author's summary.*

23.24. Formation of Stands by Planting

[1045]. 23.24 : 12.25 : 42.22. STOECKELER, J. H. **Brush shade increases plantation survival on droughty sites.** *Tech. Note Lake St. For. Exp. Sta.* No. 233, 1945. p. 1.

About 900 trees of each of eight age classes and species were planted in spots where turf had been removed in 16-in. squares. Shortly after planting, about half a dozen small branches of chokeberry and dry brush from $\frac{1}{4}$ to $\frac{3}{4}$ in. in diameter and 2 ft. long were placed over each planted tree in half the squares, mostly on the south side and straddling the square. Half the trees were left unshaded. Results of the test after 4 years are shown below:—

Age class	*Species*	*Survival, per cent.*	
		Brush shade	*No shade*
2–0	Ponderosa Pine .	46	25
2–1	„ .	82	77
2–2	„ .	52	42
2–0	Rocky Mountain Red Cedar .	95	66
2–1	„	91	77
2–2	„	51	34
2–2	Scots Pine . .	36	21

23.24.3. *Spacing*

See also *For. Abstr.* 8 (No. 1523).

[1046]. 23.24.3 : 22.83 : 12.26–8. CEYLON. **Silvicultural research: Ceylon: 1944.** Office of the Conservator of Forests, Colombo, Ceylon. 1946. pp. 16.

The old experimental mixture plots of Jak (*Artocarpus integer*) and Milla (*Vitex pinnata*) now prove beyond question that alternate line mixture of these two species is not practicable. Where soil conditions are good and favourable to Jak, this species overtops, suppresses, and even kills out the Milla. On poorer soils the Milla competes with the Jak and gets the better of it. Under the former conditions, the Jak has greatly benefited from the increased spacing of 20 × 10 ft. due to suppression of the Milla. This espacement is being converted to 20 × 20 ft. in alternate lines in the 7th and 8th year of plantation. There has been no undue opening up of the canopy in the first plot so thinned.

The first *Casuarina equisetifolia* plots to be planted at the increased espacement of 10 × 10 ft. instead of the previous 6 × 6 ft. [see *For. Abstr.* 7 (No. 1760)] have been thinned to 20 × 20 ft. quincunx and have responded well; the crowns are heavy, much better developed,

and already beginning to interlace. Breast-height girths are well above the best for the same age in the rest of the plantation and there is no falling short in height (pp. 3–4).

23.26. Plant Rearing. Nursery Practice

See also *For. Abstr.* 8 (No. 1435).

[1047]. 23.26 : 21.3 : 12.11. FORBES, R. H. **Sand culture—a suggestion.** *J. For.* 44 (5), 1946 (376).

During the winter of 1945 sand-culture apparatus was installed by the writer in the Oregon State College greenhouses and Douglas Fir seedlings were grown in it for 2½ months. The results tend to confirm the reported advantages of sand as an artificial medium. Sand-culture seedlings possessed roots with abundant secondary and tertiary branching, while seedlings grown in a leafmould/sand soil had a shorter primary root and only a few secondary branches. This excellent characteristic in planting stock appears to be correlated with the coarse texture of the medium in which growth took place.

[1048]. 23.26 : 23.23 (494). Samenmenge und Bedeckungstiefe bei Saaten in Pflanzgärten. Semis et profondeur des semis en pépinière. **[Quantity of seed and depth of sowing in nurseries.]** *Merkblatt der Beratungsstelle für Waldsamenbeschaffung* (*Mémorandum de l'Office de renseignements et conseils pour l'obtention de graines forestières*). No. 4, 1946, pp. [2]. [G.F.] *Suppl.* to *Schweiz. Z. Forstw.* 97 (8/9), 1946.

Brief notes and tabular data for species grown in Switzerland.

[1049]. 23.26.4 : 07.7 : 23.61. UMLAND, C. B. **Nursery weeding costs reduced by mechanical cultivation.** *J. For.* 44 (5), 1946 (379–80).

Description of an improved mechanical weeder designed and adapted to conditions at the Muscle Shoals forest nursery of the T.V.A. at Wilson Dam, Alabama. One year's use of this cultivator resulted not only in a saving of 40·6 per cent. in weeding costs, but also in the production of better seedlings by actually improving growing conditions in the seedbed.

23.3. *Afforestation*

[1050]. 23.3 (41.5). DEASY, J. J. **Some notes on coastal afforestation in Co. Wexford.** *Irish For.* 3 (1), 1946 (29–39 + plate).

Notes on the afforestation by the Irish Forestry Department of a tract of sand dunes at Curracloe, Co. Wexford. The planting was done in 1930–31, the species most used being Scots Pine, Corsican Pine, Maritime Pine and Sitka Spruce. Other species used were *Pinus contorta*, Mountain Pine, Austrian Pine, *P. radiata* and Black Alder. Scots Pine suffers from blast, has been seriously attacked by the Pine shoot moth (*Evetria buoliana*), and is evidently not suited to this site. Taking all factors into consideration, the safest species now appear to be Maritime Pine, *Pinus radiata*, Austrian Pine, Corsican Pine, and *P. contorta*, in that order.

An area of 36 acres was also sown in 1931–32 with Maritime Pine seed. The progress of most of the seedlings was disappointing during the first few years; about 5 per cent. made satisfactory progress, but the rest lagged behind. After 4 or 5 years, however, the seedlings that survived the check period came away satisfactorily.

In 1940 some experimental plots of Maritime Pine were planted, using 1-year seedlings divided into 4 lots which had received different nursery treatments: (*a*) seedlings wrenched once during the summer, lifted and lined out in October following, (*b*) seedlings wrenched once during the summer, 'balled' (i.e. roots covered with a ball of nursery soil with an outer covering of moss tied on to hold the soil in place) and lined out in October following, (*c*) seedlings wrenched twice, balled and lined out in October, (*d*) seedlings not wrenched, but balled and lined out in October. The losses were lightest in the case of (*c*) and heaviest in the case of (*d*). Losses in (*a*) and (*b*) were the same. At present the growth of surviving plants of (*a*) and (*b*) is about the same. Growth in (*c*) is better than (*a*) and (*b*), and growth in (*d*) is better than in (*c*).

[1051]. 23.3 (44) : 11.48.5. CUIF, E. La technique moderne du boisement de la Champagne crayeuse. **[The modern technique of afforestation on the Champagne chalk.]** *Rev. Eaux For.* 79 (3), 1941 (153–65). [F.]

[1052]. 23.3 (44) : 11.49.0. RIVÉ, A. La Sologne, son reboisement. **[The reforestation of the Sologne.]** *Rev. Eaux For.* 78 (7–9; 10–12), 1940 (289–306; 349–58). [F.]

Account of the history and present condition of afforestation in the Sologne region of France, which consists of very acid sandy soil over impermeable clays. Deforestation, which has always been disastrous to this region, has been in progress since the war of 1914–18, and of the 120,000 ha. planted to conifers in the 19th century, more than one-half had been felled at the time of writing, and had reverted to heath or scrub. When large-scale planting began about 1870, the species chiefly planted was *Pinus pinaster*, which did very well until the winter of 1879–80, when an unusually severe frost killed it almost entirely over an area of 60,000 ha. The most generally planted species now is *P. sylvestris* which grows well, is not subject to serious insect or fungus attack, and regenerates naturally except on very dry sites. More recently, Douglas Fir has been planted with considerable success on the better soils. Suggestions are made for a programme of reforestation for the whole area.

[1053]. 23.3 (44) : 42.21. LACHAUSSÉE. La technique du boisement des trous à gelées. **[The technique of afforestation of frost pockets.]** *Rev. Eaux For.* 79 (7), 1941 (506–9). [F.]

Frost pockets are very frequent in depressions in the Jura, covering some thousands of hectares. A sure and prudent method of afforesting them is by progressive, concentric replanting of the sides of the depression with Spruce of local provenance. As the plantations grow, the corridors of cold air are progressively obstructed and the area of the frost pocket diminished. This process is necessarily a slow one and quicker results have been obtained by planting the whole area of a frost pocket with *Pinus montana* var. *uncinata* Ram., which is exceedingly resistant to frost, and in due course provides shelter in which Spruce can be raised. It is important that the *uncinata* variety should be used for this purpose, and not one of the prostrate varieties.

[1054]. 23.3 (494) : 38.8. OECHSLIN, M. Die Aufforstungen und Verbauungen im Einzugsgebiet des Gangbaches bei Spiringen-Bürglen, Kanton Uri. **[Afforestation and torrent training in the catchment of the Gangbach at Spiringen-Bürglen, Canton of Uri.]** *Schweiz. Z. Forstw.* 97 (7), 1946 (261–76 + plates). [G.f.]

A descriptive and historical account of the project, which is still not completed, with a statement of costs to date.

[1055]. 23.3 (54.2) : 11.62.11. NICHOLSON, J. W. **Some afforestation problems in Orissa.** *Indian For.* 72 (4), 1946 (157–8). (6th Silvicultural Conference, Dehra Dun, 1945.)

Notes on the Puri *Casuarina* plantation and on contour ridging-cum-trenching in the Palamau division.

A spacing of 8 × 8 ft. and mechanical thinnings at 6 and 12 years have been prescribed for *Casuarina*. Attempts to introduce tree species other than *Casuarina* have generally been a failure. *Anacardium occidentale* and (given side shade) *Calophyllum inophyllum* have done moderately well, but revenue from these two species has been negligible. On the other hand the original *Casuarina* plantation (now being extended by a further 1,000 acres) has paid more than 4 per cent., calculated at compound interest, on the capital outlay.

Presumably as a result of a fall in the water table due to a cut from the Sur Lake through the plantation to the sea in 1931, and the deepening of the cut in 1940–41, trees have died off over large areas. The most baffling problem, however, is the inequality of growth on level sands, believed to be due, at least in part, to the presence of a yellowish iron-coloured stratum which the *Casuarina* roots do not readily penetrate.

Although the author admits the value of contour trenching on eroded or barren slopes, he does not consider that the cost of contour trenching in existing forests is justified unless a particularly valuable crop is to be grown.

[1056]. 23.3 (54.5) : 96.5. HAMILTON, A. P. F. **Some afforestation problems in the Punjab plains.** *Indian For.* 72 (3), 1946 (111–14). [Punjab Forest Department.] (6th Silvicultural Conference, Dehra Dun, 1945.)

A discussion of some problems involved in the afforestation of (1) the Sind Sagar Doab, a tract situated in the south-west of the Punjab above the confluence of the Chenab and Indus rivers, and (2) the Chenab riverain or *bela* lands.

The forests of the former area lie on the old bed of the River Indus, which is tending gradually to move westwards, leaving behind numerous branches which help to inundate the newly formed land (*kachi*). The pioneer species which invade the *kachi* are *Tamarix dioica* and *Saccharum spontaneum*. As the land becomes more elevated, *Populus euphratica* and *Acacia arabica* appear. These flourish as long as inundations continue; but as moisture conditions deteriorate they give way to *Saccharum munja* and *Dalbergia sissoo*. Forest crops of the above types have been managed successfully for a long time on favourable soils, but considerable tracts of *thur* and *rappar* land exist which it has not been possible to afforest up to the present. The author discusses the silvicultural problems involved in the afforestation of these saline soils.

Conditions in the *bela* lands are more favourable for forest growth, and natural Sissoo forests have been under management for a long time. Stump-planting of fresh areas by the usual methods did not, however, meet with success and the author describes the new and promising 'boat pit' technique [cf. *For. Abstr.* 7 (No. 744)].

[1057]. 23.3 (54.8). MASCARENHAS, J. P., and PAIS, S. **Trench-mound method of afforestation.** *Indian For.* 72 (2), 1946 (97–9 + plate). [Mysore Forest Service.] *Extr.* from *Indian Fmg.* 6 (3), 1945.

An account of the afforestation of bare hill slopes in Mysore with working procedure for trench and mound sowings, patch sowings, and a method closely related to *taungya* whereby *Casuarina* plantations are raised for the first few years in ploughed land bearing crops of horse-gram, Bengal-gram, or the like. The selection of species for use by the first two methods is largely determined by local requirements and climatic conditions. A list is given of suitable tree species yielding (1) leaf fodder; (2) leaf manure; (3) fuel; and (4) fruit or other economic products.

[1058]. 23.3 (54.8 : 54.2). JOSHI, K. D. **Trench-mound method of afforestation.** *Indian For.* 72 (5), 1946 (235). [Naini Tal Forest Division.]

Comment on an article by J. P. Mascarenhas and S. Pais [see preceding abstract]. Similar afforestation work in the United Provinces has largely failed, because the species planted (*Acacia arabica, A. catechu, A. leucophloea, Dalbergia sissoo, Prosopis spicigera, Albizzia lebbek*, etc.) have survived only on the more hospitable soils of the lower slopes and depressions leaving the upper slopes as bare as before. A covering of grass and small shrub growth should be well established (thus providing an organic layer and causing a slow breaking-up of the soil underneath) before the planting of trees is attempted.

23.4. *Formation of Forest by Natural Succession*

[1059]. 23.4 (54.2) : 96.5 : 23.3. JOSHI, K. D. **Afforestation of dry and desert areas with a rainfall of below 30 inches in the United Provinces.** *Indian For.* 72 (3), 1946 (120–3). [Afforestation Division, U.P.] (6th Silvicultural Conference, Dehra Dun, 1945.)

Extensive afforestation operations were carried out in the Etawah district of the United Provinces between 1914 and 1929, after which the policy of tree planting was abandoned in favour of the present policy of natural restocking induced by protection and the regulation of grazing. The change of policy was due largely to the failure of deep-rooted species such as *Dalbergia sissoo* and *Acacia arabica* after about 10 years, when their roots were arrested by the impenetrable *kankar* (calcareous nodules) pan beneath the top soil layers. The author gives an outline of the methods of afforestation adopted in 1914–29. Under the present policy the areas are being protected as fuel and fodder reserves. The growth of indigenous fodder grasses and fuel species (such as *Acacia leucophloea* and *Prosopis spicigera*) is encouraged. No artificial propagation of tree species is contemplated.

[1060]. 23.4 (67.5) : 12.19.4. GERMAIN, R. Note sur les premiers stades de la reforestation naturelle des savanes du Bas-Congo. **[Note on the first stages of natural reforestation of the savannas of the Lower Congo.]** *Bull. agric. Congo belge* 36 (1–4), 1945 (16–25). [F.]

Studies were made in two areas of the Lower Congo, one of calcareous schists and the other of poor schists, after periods of fire exclusion varying from 2 to 10 years. The first effect of

fire exclusion is the proliferation and increasing dominance of the dominant grass of the region (*Hyparrhenia diplandra* in the first case and *Andropogon schirensis* in the second) which continues until they begin to decline and seedlings of savanna trees species and a few invading species can get a footing. Most invading species come in under a light cover, spreading outwards from the edges of islands of savanna species and eventually crowding out the grasses. The typical, low, light-demanding savanna species disappear in turn as a continuous closed canopy is formed. The habit of the trees is equally modified. The scanty, fastigiate crown, the result of successive fires, is transformed into a much denser, spherical crown; this change is particularly noticeable in species of *Sarcocephalus* and *Bridelia*. Observations made in savanna which had been protected for 4 years showed that those species such as *Macaranga*, which can apparently only regenerate under the shelter of a tree, have a superficial root system, while others such as *Harungana* or *Vernonia*, which have a deep or intermediate root system, come up indifferently under tree shelter or amongst tufts of grass.

It is concluded that simple closure to fire and felling is the surest and most economical way of reforesting the savannas of the Belgian Congo. The writer is opposed to any artificial interference, particularly in bush savanna, where weeding or any other disturbance of the soil merely increases the spread of grasses; on clay soils, *Imperata* is the grass which first appears. In protected areas, the rapidity of reforestation will be a function of: (1) the density of woody cover at the time of closure; (2) the proximity of secondary formations, gallery forests, etc., which will provide the invading species; and (3) the degree of compactness of the soil. In choosing an area for protection, due regard should be had to the existence of seed sources to windward. Experiments might be made in scattering seed of savanna species (*Sarcocephalus*, *Bridelia*, *Euphorbia*, *Millettia versicolor*) and deep-rooted invading species (e.g. *Harungana*) in protected grassy savanna.

23.5. *Underplanting*

[1061]. 23.52 : 12.26–8. HERMANN, F. J. **Economic plants of interest to the Americas: leguminous shrubs and trees used as shade and cover crops in tropical and subtropical countries.** Office of Foreign Agricultural Relations, U.S. Department of Agriculture. [1943?] pp. 17.

Notes on the leguminous tree species used in different parts of the world for shading Coffee, Cocoa and Tea plantations.

24. TENDING OF STANDS AND TREES

See also *For. Abstr.* 8 (Nos. 1478, 1481).

24.1. *Cleanings*

[1062]. 24.1 : 45.1. CEYLON. **Silvicultural research: Ceylon: 1944.** Office of the Conservator of Forests, Colombo, Ceylon. 1946. pp. 16.

General high slashing of shrub and other non-economic species to release preferred and other timber species in secondary dry scrub jungle has proved more satisfactory than cleaning restricted to narrow strips. Such strips come to be used as paths by game and lead to barking and browsing of the species in whose favour cleanings are done (p. 7).

24.2. *Thinnings*

[1063]. 24.21 : 12.26–8. LANZ, C. Die Gewinnung von Buchendurchforstungsmaterial. **[Obtaining wood from thinning Beech stands.]** Schweizerischer Verband für Waldwirtschaft, Solothurn. 1940. pp. 103. [G.f.] P.R.

[1064]. 24.25 : 11.22 : 56 : 12.25. CHEO, K.-H. **Ecological changes due to thinning Red Pine.** *J. For.* 44 (5), 1946 (369–71).

During the growing seasons of 1936 and 1937 a comprehensive study of environmental factors was carried out in 4 thinning plots which had been established in 1927 in a 15-year-old Red Pine stand at the Cloquet Forest Experiment Station [cf. *For. Abstr.* 7 (No. 1189)]. The effect of thinning on the air temperature was very evident. The mean maximum temperature increased with the degree of thinning, while mean minimum temperatures decreased still more appreciably. Using the 4×4 spacing as a basis of comparison, it was found that in the 6×6 spacing 15·4 per cent. more precipitation reached the ground, in the 7×7 spacing 32·9 per cent.

more, and in the 9 × 9 spacing 49·2 per cent. more. Differences in relative humidity were not constantly significant for all spacings. Comparing the various plots with the 4 × 4 spacing, the 6 × 6 evaporated 8 cc. less per day, the 7 × 7, 1·4 cc. more per day, and the 9 × 9, 3·3 cc. more per day. These differences were highly significant statistically. The lower evaporation rate in the 6 × 6 spacing is difficult to account for. The 4 × 4 spacing averaged 15·4 per cent. of full sunlight, the 6 × 6, 16·5 per cent., the 7 × 7, 36·1 per cent., and the 9 × 9, 60·2 per cent. These averages show highly significant differences, except between the 4 × 4 and 6 × 6 spacings. This variation may be accounted for by the more vigorous development of the crowns in the 6 × 6 spacing. In general the soil temperature increased with the degree of thinning, and rose more rapidly in the heavily thinned plots in the spring. Soil temperatures reached a point at which root growth could be expected to begin, 2 weeks earlier in 9 × 9 than in 4 × 4 spacing. Average soil moisture content increased with the degree of thinning.

The 6 × 6 and 7 × 7 spacing seem to provide better environmental conditions than the 4 × 4 and the 9 × 9. The closer spacing of the 4 × 4 plot results in too much competition; the dense stand intercepts too much rainfall, which results in a lower moisture content and lower soil temperatures. The more open spacing of the 9 × 9 plot brings about too high evaporation rates, too high soil temperatures, and too much light. The best growth occurred in the 6 × 6 spacing for the selected crop trees. This would indicate that the 6 × 6 plantations need not be thinned until at least 25 years old. The 7 × 7 spacing was second, the 4 × 4 third, and the 9 × 9 last. This would indicate that wide spacing in planting may, at least in some instances, react unfavourably on the rate of growth of the stand.

[1065]. 24.25 : 12.26–8 : 56 (74). HOUGH, A. F. **Improvement of second growth northern hardwoods by cordwood thinnings.** *For. Mgmt. Note Ntheast. For. Exp. Sta.* No. 1, 1946. pp. 4.

Observations on a series of thinned and control plots in Allegheny National Forest where commercial thinnings for chemical- and pulpwood have been made during the past 4 years. Untreated stands grow at the rate of 1·0–1·2 cords per acre per year during the first 40 or 50 years and at an even slower rate afterwards. After the proper degree of thinning the residual stand grows at the rate of 1·4–1·8 cords per acre per year during the succeeding 2–4 years, as compared with an average of 1·2 cords for the same period on the unthinned control plots. Competition is expected to slow down the growth rate again after 10 years.

24.3. *Opening of the Canopy. Release and Improvement Fellings (including Poisoning and Girdling)*

[1066]. 24.3. CEYLON. **Silvicultural research: Ceylon: 1944.** Office of the Conservator of Forests, Colombo, Ceylon. 1946. pp. 16.

Further experiments confirm the greater speed and efficiency of poison-frill-girdling compared with plain deep girdling for killing unwanted trees [cf. *For. Abstr.* 7 (No. 1785)]. The former has the further advantage that the more sudden opening checks the growth of trees of the middle storey and undergrowth, whereas a more gradual opening of the canopy tends to stimulate their growth and so fails to effect the primary object of inducing natural regeneration. Sodium arsenite has proved very efficacious for the purpose of poison-frill-girdling (pp. 10–11).

[1067]. 24.2 : 12.26–8 : 12.19.4 (74.7). TRYON, H. H. **The management of young volunteer hardwood stands.** *Black Rock For. Bull.* No. 13, 1945. pp. 28.

Release cuttings in young stands of mixed hardwoods must not be made too early. The crop species should be at least 7–8 ft. high. On the other hand, work should not be too long delayed. It is better to make two light operations rather than one heavy one. The stands of Birch so frequently found on clear cuttings are pioneer associations and should be managed for cordwood with the object of having the Birch cover almost entirely removed by the time the expected understorey of better commercial species has become thoroughly established. Where aggressive weed trees have to be cut back more than once, the sprouts should be cut back at the point of origin in second and subsequent operations; the main parent stem should not be cut again.

[1068]. 24.36 : 12.25 : 21.64. LeBarron, R. K. **What causes mortality in Black Spruce after partial cutting?** *Tech. Note Lake St. For. Exp. Sta.* No. 231, 1945. p. 1.

Cf. *For. Abstr.* 7 (No. 1154).

[1069]. 24.36 : 12.25 : 56. Krauch, H. **The influence of release on the diameter growth of trees in Douglas-fir cut-over stands in the Southwest.** *Res. Note Sthwest. For. & Range Exp. Sta.* No. 111, 1945. pp. 3.

Data are given showing comparative growth of released and non-released Douglas Fir and White Fir. For Douglas Fir, the effect of release is relatively greater in older trees than in younger trees, and greatest in the over-mature. Growth response is relatively greater in small-crowned trees than it is in the larger crowned. While there is a falling off of diameter growth with increase in diameter, basal-area growth is pretty well maintained, and rises in most instances in thrifty released trees, thus indicating that large Douglas Fir and White Fir trees will, when well released, make good volume growth.

24.5. *Pruning*

[1070]. 24.5. Schaeffer, L. La pratique de l'élagage. **[The practice of pruning.]** *Rev. Eaux For.* 79 (4), 1941 (263–75). [F.]

Detailed notes on the principles and technique of pruning as applied to different species. The writer urges the need of impressing on the timber trade the greater value of logs from properly pruned trees.

[1071]. 24.5 : 91.4. [Roubaud and Colas-Belcour]. Élagage et hygiène. **[Pruning and hygiene.]** *Rev. Eaux For.* 79 (10), 1941 (760–1). [F.]

In the cavities resulting from pruning of a Spanish Chestnut at Neuilly-sur-Seine, were discovered eggs of two species of mosquito, *Aedes geniculatus* and *A. pulchritarsis*, which are akin to the vector of yellow fever and have similar infectious aptitudes. Experiments showed that the eggs would hatch after months of dryness, when rain water soaked into the rotten wood. It is therefore desirable, as a matter of hygiene as well as from consideration for the appearance and health of the tree, to exercise care in pruning trees in parks, streets, etc., near towns and villages, so as to obtain a good growth of callus over the wounds, and if necessary to seal up wounds which have not perfectly healed.

[1072]. 24.51 : 12.25. Paul, B. H. **Tree pruning by annual removal of lateral buds.** *J. For.* 44 (7), 1946 (499–501). [U.S. Forest Products Laboratory, Madison.]

Krotkevitch's method of tree pruning by removal of lateral buds [see *For. Abstr.* 2 (p. 106); 8 (No. 276)] is being tested in the Nicolet National Forest, Wisconsin, by the Forest Products Laboratory. About 200 trees of *Pinus resinosa*, planted in 1933, have been pruned annually since 1940 by this method. The first few sets of branches were allowed to grow, in order to nourish the tree while the experiment is in progress. Removal of lateral buds will be continued for another 5 or 6 years before trees are allowed to resume normal growth.

The advantages claimed for the method in the original Russian paper were (1) shortness of time required to produce wood suitable for aircraft, (2) better development of commercial timber than by former methods, (3) no infection of the trees by fungi, and (4) simplicity of the care of trees. The Forest Products Laboratory experiment so far substantiates these claims, but certain difficulties have arisen, which may in some cases be of considerable importance. For *P. resinosa*, the season for easy removal of buds is of short duration, following cessation of terminal height growth each year. This may be a species character or the result of climatic factors causing development of woody shoots soon after the current lateral buds are formed. After two treatments in 1940, it was found that prolific bud development on some of the terminal shoots presented another difficulty. Buds were so numerous that a terminal bud could hardly be recognized among them. With a lapse of treatment for 2 years during the war, this tendency seems to have disappeared, but the condition may return after two or three successive treatments. A third factor affecting the utility of this method of pruning is the risk of losing trees as a result of injury to the terminal shoot. Several trees have already been lost in this way after injury by White Pine weevil [*Pissodes strobi*]. An innovation that may deserve trial is the annual removal of 1-year-old

lateral branches instead of the buds. In case of injury to the terminal bud, one of the current side branches could then be left to replace the lost terminal shoot. The time required to remove 1-year-old branches with hand clippers would be slightly greater than that needed to break off buds, but the season for removal would be longer.

The cost of pruning by the Russian method would probably compare favourably with other methods. Individual treatments have so far usually required less than one minute per man per tree, but future treatments will take rather longer, because of the necessity of using a ladder. [Cf. *For Abstr.* 8 (No. 276).]

[1073]. 24.51 : 12.25. CURTIS, J. D. **Pruning forest trees by the finger-budding method.** *J. For.* 44 (7), 1946 (502–4). [Department of Forestry, Univ. of Maine, Orono, Me.]

Report on an experiment in pruning by removal of lateral buds, being conducted by the Department of Forestry of the University of Maine in two plantations of Red Pine and one of Scots Pine. In general, the results have been similar to those at Nicolet National Forest [see previous abstract], but with a few significant differences. As in the other experiment, occasional woody shoots were found on leaders, and had to be removed. Greatest damage to leaders resulted from fresh spring winds in the more exposed of the Red Pine plantations. On unpruned trees, the leaders were protected by laterals, but on pruned trees they were often snapped off. Several species of birds debudded leaders and laterals of Scots Pine. None of the Red Pine leaders was damaged by *Pissodes strobi*, but the Scots Pine were so severely attacked that on 50 per cent. of trees the first whorl of branches below the first bud-pruned whorl had to be pruned by saw to eliminate several new leaders. The original laterals on the first few feet of the pruned stems prompted the development of what has been described as a 'candelabra' tree. It is difficult to gauge when these vigorous branches are seriously affecting height growth and should be removed partially or entirely. So many of the Scots Pine had developed into undesirable individuals by the end of 1945 that it has been decided to discontinue pruning them.

Number of trees, total pruning time, growth data and damage, for pruned and control trees after 5 growing seasons are given in a table.

[1074]. 24.51 : 12.25. ISAAC, L. A. **Results of pruning to different heights in young Douglas-fir.** *For. Res. Note Pacif. Nthwest. For. Exp. Sta.* No. 33, 1945 (16–7).

Two hundred healthy trees in a 28-year-old stand of pure Douglas Fir were pruned in 1937 by one of 4 treatments, branches being sawn off flush with the bole in the autumn. In December, 1943, measurements were again made of height and diameter and observation made of any sunscald injury or epicormic branches. The results are shown in the following table:—

Extent of pruning	*Six-year period* 1937–43			
	Average growth		*New branches developed % of trees*	*Sunscald injuries % of trees*
	D.B.H. inches	*Height feet*		
Dead limbs only	1·1	9·2	0	0
¼ of live crown	1·2	9·4	2	2
½ " " "	1·0	7·9	0	12
¾ " " "	0·5	5·3	15	35

The study shows that pruning to at least one-quarter of the live limbs can be done in a stand of this character without loss of growth, and preliminary examinations show as yet no entrance of decay. Such pruning will result in at least one 18-ft. clear butt log on the crop trees at a cost that is not prohibitive.

[1075]. 24.51 : 12.26–8. CEYLON. **Silvicultural research: Ceylon: 1944.** Office of

the Conservator of Forests, Colombo, Ceylon. 1946. pp. 16.

The attenuated crowns of a plantation of Jak (*Artocarpus integer*) in which thinning had long been neglected showed renewed growth after lopping of branches to provide emergency fodder. Experiments have been initiated, to see whether judicious pruning of branches will promote response of crown to thinnings and reduce die-back and epicormic branches without inducing traumatic effects (p. 13).

[1076]. 24.51 : 31.8. Scott, C. W. **Knots —and the pruning of branches which produce knots.** *Timber News* 54 (2083), 1946 (168–70). P.R.

Types and size of knots and the factors determining knottiness in timbers are described. The advisability of pruning is discussed in the light of experience in Europe, U.S. and Canada and comments are made upon methods of pruning.

3. FOREST UTILIZATION. FOREST TECHNOLOGY

[1077]. 3 (43.1–5) : 07.2. FLEISCHER, H. O. **The Nazi woodpile in 1945.** *J. For.* 44 (5), 1946 (340–4). [Forest Products Laboratory, Madison.]

The author considers that the myth of German super-superiority in wood technology and manufacture is exploded; he contrasts the situation shortly after V-E day with that presented in 'Nazis in the Woodpile' (Glesinger, 1942). Research continued during the war, but integrated planning was weak, and industry, although not seriously crippled, suffered from obvious inefficiency in production methods. The annual cut had gradually been raised from 37 million cu.m. to about 55 million cu.m. and overcutting in 1935–45 amounted to about 180 million cu.m. or 10–15 per cent. of the total timber volume of the country. Under Allied control some overcutting will have to be continued for a decade or more to provide for reconstruction. The best use may not be made of Germany's forests because the policies of the several Allied nations may not be properly correlated.

[1078]. 3 (59.6–9 : 64 : 66 : 67.1 : 67.2 : 69) : 22. CHEVALIER, A., and NORMAND, D. Forêts vierges et bois coloniaux. [**Virgin forests and colonial timbers.**] Presses universitaires de France, 108 Boulevard Saint-Germain, Paris. 1946. pp. 128. [F.]

One of the latest volumes in the series 'Que sais-je?' The first chapter gives a general account of the extent, composition and resources of the forests of the French colonial empire. Others deal with the characters, exploitation, trade, and utilization of colonial timbers. A final chapter deals briefly with silviculture.

31. PROPERTIES AND ANATOMY OF WOOD. WOOD RESEARCH

[1079]. 31 : 33. TIEMANN, H. D. **Wood technology: constitution, properties and uses.** Pitman Publishing Corporation, New York and Chicago. 2nd ed., 1944. pp. viii + 328 + plates. Price $4.00.

The first edition (1942) was reviewed in *For. Abstr.* 4 (229). In the present edition the chemistry of wood and cellulose is the subject of a new chapter; there are new illustrations and additional information on the structure of the cell wall, moisture relations of wood, and the fibre-saturation point.

[1080]. 31 (45) : 07.2. CORMIO, L. La civica Siloteca Cormio. [**The municipal Cormio Wood Institute.**] *Pubbl. civ. Siloteca Cormio, Milano* No. 12, 1942. pp. 15. [It.] *Repr.* from *Milano*, 1942. X.

An account of the institute for wood research, founded by R. Cormio at Milan, its activities and publications.

[1081]. 31 : 33.36.3. DESCH, H. E. **Wood fallacies.** *Wood* 11 (2; 3; 4), 1946 (33–5; 75–7; 116–8).

The fallacies which the author attempts to explode are: (1) that wood is a more dangerous structural material than steel in the event of fire; (2) that all wood decays naturally in the course of time; (3) that there is such a thing as 'dry rot' of wood; (4) that some timbers never decay in any conditions; (5) that 'dead' wood is inferior to that from living trees; (6) that timber felled in winter is drier than that felled in summer; (7) that seasoning is dependent on the time factor; (8) that thoroughly seasoned timber will not shrink or swell; (9) that 'shortness' in the grain is a defect of some timbers; (10) that wood free from defects is obtainable in ordinary commercial practice; and (11) that timber names are not misleading.

31.0. *General Information on Woods*

[1082]. 31.0 : 01.2. RENDLE, B. J. **Names of timber trees.** *Ann. appl. Biol.* 32 (2), 1945 (184–5). [Forest Products Research Laboratory, Princes Risborough, Bucks.] O.R.E.

With reference to the Empire Forestry Association's list of standard trade names of Empire timbers; to the British Standard Nomenclature of Softwoods and Hardwoods, now combined in a single 'British Standard Nomenclature of Commercial Timbers'; and to the Sixth International Botanical Congress resolution 'that an International Committee be appointed to draw up a list of names of economic plants according to the "International Rules" and that this list may remain in use for a period of ten years'.

[1083]. 31.0 (410) : 21 : 31.2 : 33.36.3. BOULTON, E. H. B., and JAY, B. A. **British timbers: their properties, uses and identification, with notes on the growth and cultivation of trees.** Adam and Charles Black, 4, 5 and 6 Soho Square, London, W.1. 2nd ed., 1946. pp. 120 + plates. Price 12*s.* 6*d.* [Timber Development Association.]

[Cf. *For. Abstr.* 6 (93) for an extensive review.] In the second edition of this book, the authors increase its usefulness by the inclusion of tables of strength figures and kiln schedules for the more important British timbers, and of notes on their fuel value.

[1084]. 31.0 (71.4). BOUTIN, F. Les bois commerciaux de la province de Québec. [**The commercial timbers of Quebec.**] *Rev. int. Bois* 13 (104; 105), 1946 (31–9; 54–62). [F.]

[1085]. 31.0 (728.2) : 12.26–8. **Notes on forty-two secondary hardwood timbers of British Honduras.** *Bull. For. Dep. Brit. Hond.* No. 1, 1946. pp. 116 + map + index.

[1086]. 31.0 (932–9) : 33.1 : 82. CAMERON, S. **Some notes on utilization of timbers in the South-west Pacific.** *N.Z. J. For.* 5 (2), 1945 (117–27 + plates).

Notes on commercial aspects of species encountered during operations in the New Guinea Territories of Manus, Los Negros, and New Britain: *Pometia pinnata, Afzelia bijuga, Calophyllum* spp., *Alstonia scholaris, Cedrela toona, Eugenia* spp., *Homalium pachyphyllum, Sarcocephalus cordatus, Eucalyptus naudiniana, Casuarina* spp., *Xylocarpus granatum, Parinarium griffithianum, Pterocarpus indicus, Dysoxylum* spp., *Terminalia* spp., *Vitex cofassus.* The writer discusses conversion during the campaign and some of the difficulties in the way of post-war commercial utilization of New Guinea forests.

[1087]. 31.0 : 12.25. Lärche. [**European Larch.**] *Holz* 3 (3), 1940 (103–4). [G.]

[1088]. 31.0 : 12.25. MCDONALD, R. S. **Pacific Coast Hemlock.** *Timb. Tr. J.* 177 (3643; 3644), 1946 (1136–7; 1237–9).

An account of the qualities of Western Hemlock (*Tsuga heterophylla*) timber, which, if properly seasoned, is very little inferior to that of Douglas Fir. This species, which is much superior to Eastern Hemlock (*Tsuga canadensis*), is rapidly becoming the dominant species in coastal British Columbia. The necessity of seasoning Hemlock lumber before export is stressed.

[1089]. 31.0 : 12.26–8. **Specimen woods No. 126: White Olivier** (*Terminalia amazonia*). *Suppl.* to *Wood* 11 (6), 1946 (163–4).

[1090]. 31.0 : 12.26–8 (59.5) : 33. DESCH, H. E. **Dipterocarp timbers of the Malay Peninsula.** *Malay. For. Rec.* No. 14, 1941. pp. 171 + plates.

This volume is divided into 9 parts: Parts 1–8 are descriptions of the timbers of genera, arranged in order of commercial importance, and part 9 contains a discussion of the significance of the anatomical structure of the wood within the Dipterocarpaceae. The genus *Shorea* was dealt with in an earlier volume (1906), but a revised account of the genus is given in this one. [See also *For. Abstr.* 8 (No. 953).]

[1091]. 31.0 : 12.26–8 : 21. BERKEL, A. Şark Kayini (*Fagus orientalis*, Lipsky) nin teknolojik vasiflari ve istimali hakkinda araştirmalar. [**Investigations on the properties and uses of the wood of Oriental Beech.**] *Çalişmalar. Yüksek Ziraat Enst., Ankara* No. 118, 1941. pp. 100 + 81. [Tur.tur.G.g.]

Cf. *For. Abstr.* 4 (105).

[1092]. 31.0 : 12.26–8. **Specimen woods No. 127: Tasmanian Myrtle** (*Nothofagus cunninghamii*). *Suppl.* to *Wood* 11 (7), 1946 (193–4).

[1093]. 31.0 : 12.26–8. **Specimen woods No. 124: Cramantee** (*Guarea excelsa*). *Suppl.* to *Wood* 11 (4), 1946 (103–4).

[1094]. 31.0 : 12.26–8. BRUSH, W. D. **Iroko** (*Chlorophora excelsa*). U.S. Forest Service: *Foreign Woods.* 1943. pp. 9 + map.

[1095]. 31.0 : 12.25–8 (68.3 : 68.4) : 23.3. RATTRAY, L. C. M. **The cultivation of timber and possibilities for future expansion in the sugar belt of Natal and Zululand.** *Proc. S. Afr. Sug. Technol. Ass.* 19, 1945 (71–4). L.S.

The writer discusses the problem of finding economic uses for the large plantings of *Eucalyptus saligna* which have been made in

Zululand. The primary object of these plantations was the provision of mining timber, but they are much in excess of the needs of the mining industry. Analysis showed that wood from a 6-year-old *E. saligna* furnishes an excellent yield of pulp under comparatively mild treatment with caustic soda and produces a fairly soft, opaque paper of good strength. The pulp somewhat resembled commercial Poplar pulp but was composed of rather long fibres (averaging 1·4 mm.); the paper was stronger than that furnished by Poplar pulp, but required a strong bleaching solution to bleach it even a moderately pale colour. It is considered that the wood with a mixture of Pine would also provide a pulp suitable for the manufacture of artificial silk. Further tests are being made with this end in view.

If properly seasoned and sawn, the timber is satisfactory for flooring and box shooks. The chief defect, as in the pulp and paper tests, is loose knots, which shows that proper silvicultural methods are necessary if high-grade material is to be produced. The timber must be sawn immediately after felling and stacked immediately after sawing. In order to obtain straight lumber, the wood must be sawn with due regard to the extraordinary stresses that are latent in this timber, and all these stresses must be removed simultaneously. The best timber is obtained from coppice growth. *Pinus caribaea* also does very well in this country, growing at a rate of 5 or 6 ft. per annum. It is easily established and grows well in swampy land, provided that the water is not stagnant. A planting programme combining these two species should bring in good returns from 8 years of age with *E. saligna* and 14 years with *P. caribaea*.

[1096]. 31.0 : 12.26–8. **Specimen woods No. 128: Sapodilla** (*Achras sapota*). *Suppl.* to *Wood* 11 (8), 1946 (223–4).

[1097]. 31.0 : 12.26–8 (67.7). Cormio, R. L'*Avicennia marina* del Oltre Giuba: sue caratteristiche anatomiche e meccaniche e sue applicazioni. [**The *Avicennia marina* of Somaliland: its anatomical and mechanical characters and uses.**] *Repr.* from *Lignum* No. 5–6, 1939. pp. 11. [It.] X.

[1098]. 31.0 : 12.26–8. Brush, W. D. **Teak** (***Tectona grandis* L.f.**). U.S. Forest Service: *Foreign Woods*. 1945. pp. 13 + map.

31.1. *Structure. Anatomy. Identification*

See also *For. Abstr.* 8 (No. 1402).

[1099]. 31.1. Desch, H. E. **Timber identification as a campaigning problem.** *Wood* 11 (7), 1946 (186–9).

With reference to the use of card keys in the Far East.

[1100]. 31.1 : 12.25. Loubière, A. Aperçu sur les particularités structurales du bois secondaire des conifères. [**Survey of the structural characteristics of the secondary wood of conifers.**] *Bull. Mus. Hist. nat., Paris* (*2e Sér.*) 15 (5), 1943 (353–8). [F.] L.S.

[1101]. 31.1 : 12.25 : 56.02. Oppenheimer, H. R. **Cambial wood production in stems of *Pinus halepensis* (with anatomical and silvicultural notes).** *Repr.* from *Palest. J. Bot.* (*R. Ser.*) 5 (1), 1945 (22–51).

Among the external factors influencing cambial growth, total precipitation seems highly important, while temperature and relative humidity of the air play rather a secondary and unimportant rôle. Cambial activity during the greater part of the year is correlated with a surprisingly quick development of the Aleppo Pine during the first 20 years of its life. A short anatomical description is given of the metaxylem body of *Pinus halepensis*. Its elements resemble those of *P. sylvestris*, but bordered pits between the living cells of medullary rays and the tracheids are generally arranged in two rows instead of one and are much smaller than in *P. sylvestris*. *From author's summary.*

[1102]. 31.1 : 12.26–8 : 09.2. Loubière, A. De la valeur diagnostique des caractères structuraux dans l'étude comparative des bois vivants et fossiles des Dicotylédones. [**On the diagnostic value of structural characters in the study of living and fossil dicotyledonous woods.**] *Bull. Mus. Hist. nat., Paris* (*2e Sér.*) 13 (5), 1941 (489–94). [F.] L.S.

[1103]. 31.1 : 12.26–8. Tortorelli, L. A. La disposición estratificada de los elementos leñosos en el Ibirá-Itá (*Muellera glaziovii*). [**The stratified arrangement of the woody elements in *Muellera glaziovii*.**] *Darwiniana* 7 (1), 1945 (58–61 + plate). [Span.] O.B.D.

[1104]. 31.1 : 12.26–8. NORMAND, D. Note sur l'anatomie du bois du genre nouveau *Okoubaka*. **[Note on the anatomy of the wood of the new genus *Okoubaka*.]** *Repr. from Bull. Soc. bot. fr.* 91 (1–3), 1944 (20–5). [F.] X.

The writer proposes that *Octoknema okoubaka* Aubr. et Pellegr. should be taken as the type of a new genus *Okoubaka*, and renamed *Okoubaka aubrevillei*, basing his recommendation on anatomical differences revealed by examination of the woods of this species and of *Octoknema borealis*.

31.2. *Physical Properties*

[1105]. 31.2 : 12.26–8 (729.5). WELLWOOD, R. W. **The physical-mechanical properties of certain West Indian timbers, I.** *Carib. For.* 7 (2), 1946 (151–89). [E.Span.e. span.f.] [Commonwealth Plywood Co., Ltd., Ste. Thérèse, P.Q., Canada.]

This paper deals with the properties of Tabonuco (*Dacryodes excelsa*), a native of the montane forests of Puerto Rico and the most important timber tree of that island. The wood should produce attractive veneers, having an interlocked grain, ribbon-type figure and a lustrous brown colour.

31.21. Grain. Conductivity

[1106]. 31.21.33 : 07.7. ANDERSON, E. A., KOEHLER, A., and KRONE, R. H. **Instruments for rapidly measuring slope of grain in lumber.** *Rep. U.S. For. Prod. Lab., Madison* No. 1592, 1945. pp. 4 + tbl. + figs.

Slope of grain in wood is expressed as the relationship between the unit deviation and the length of base line from which the deviation occurs. A combination of the slope of grain on adjacent portions of any two surfaces at right angles to each other gives the true slope of grain within a piece near both surfaces. Direction of grain may be determined by a scribe, free-flowing ink, magnification, or, in some woods, observation of resin ducts and large pores, or, on tangential and radial surfaces, by the direction of seasoning checks and annual rings. The report gives instructions for making measurements and a table for determining the combined slope from the two figures obtained. Four measuring instruments are described and illustrated. These are:—a glass plate with lines drawn at various angles from a straight line at right angles to one edge; an instrument consisting of a straight edge pivoted on the end of a flat bar with a slide attached; adjustable parallel bars; and calipers. [Cf. *For. Abstr.* 6 (96).]

[1107]. 31.21.4. MACLEAN, J. D. **Temperatures obtained in timbers when the surface temperature is changed after various periods of heating.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1609, 1946. pp. 30 + tbls. + figs. P.R.

The paper demonstrates how approximate temperatures of wood may be determined at any time after the surface temperature has been changed. Factors affecting the rate of temperature change in wood, and fields where such information is useful, are discussed. The method of calculating temperatures in round and sawed timbers, when the initial heating temperature applied to the surface has been increased or reduced, is described and formulae for making such calculations are given. Graphs are included for reference when making calculations and to illustrate examples.

31.22. Relation to Water, Air, Gases

See also *For. Abstr.* 8 (No. 1295).

[1108]. 31.22 : 31.23. MACLEAN, J. D. **Effect of moisture changes on the shrinking, swelling, specific gravity, air or void space, weight and similar properties of wood.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1448, 1944. pp. 29 + tbls. + figs. P.R.

The report gives formulae for calculating the moisture content of wood, both on the basis of the weight of the oven-dry wood and on that of the total original weight of the wood. Graphs illustrate pounds of water per cu. ft. and percentage of total volume occupied by water, wood substance and air space in wood with varying moisture content and specific gravities, and the equilibrium moisture content of wood at varying temperatures and humidities. A table gives the average radial, tangential and volumetric shrinkage from the green to the oven-dry state for various species. Changes in specific gravity and the volumetric shrinkage from the green to the oven-dry condition for

woods having different specific gravities, and the relationship between original weight, moisture content and the specific gravity based on weight and volume when oven-dry are all illustrated by curves. Equations are given for calculating the specific gravity, weight of water per unit volume of wood, percentage of volume occupied by water and percentage air space in wood.

[1109]. 31.22 : 31.23 : 31.24 : 31.27. PALLAY, N. A fák víztartalma. A szabad és kötött víz befolyása a müszaki tulajdonságokra. **[The water content of woods. The influence of free and bound water on physical and mechanical properties.]** *Erdész. Kiséri.* 45 (1/4), 1943–4 (161–212). [Hu.g.]

A general review of the rôle of water in wood; variations with position in tree, age, felling season, etc.; importance in seasoning; effect on specific gravity, weight per stacked unit volume (with special reference to fuelwood), on shrinkage, static strength properties and resistance to impact.

[1110]. 31.22.2 : 31.23. KNUCHEL, H. Untersuchungen über das Raumgewicht und das Schwindmass schweizerischer Hölzer. **[Investigations on the specific gravity and shrinkage of Swiss timbers.]** *Mitt. schweiz. Anst. forstl. Versuchsw.* 23 (2), 1944 (471–503 + plates). [G.g.f.]

The specific gravity of the green, air-dry and absolutely dry wood of over 1,000 test pieces cut from 32 species grown in various Swiss localities was determined; the shrinkage to air-dryness and absolute dryness was calculated and compared with the data in Kollmann's 'Technologie des Holzes' (1936). The densities r_0 agree very well but the values for shrinkage in length and volume are, on the whole, lower than those given by Kollmann. This reduction in the amount of shrinking is thought to be due to internal tension produced by the unusually large dimensions of the test pieces (50 cm. × 6–10 cm. × 2–3 cm.). A further explanation of the particularly marked differences recorded for longitudinal shrinkage is that exact measurements are more difficult on small specimens than on pieces large enough to allow the use of special instruments. The timber industry uses test pieces of dimensions similar to those examined by the author.

31.27. Mechanical Strength

See also *For. Abstr.* 8 (Nos. 1177–9, 1184, 1188, 1288).

[1111]. 31.27. HEARMON, R. F. S. **The fundamental frequency of vibration of rectangular wood and plywood plates.** *Proc. phys. Soc., Lond.* 58, pt. 1 (325), 1946 (78–92). [Forest Products Research Laboratory, Princes Risborough.] L.S.

Equations are derived expressing the frequency of vibration of rectangular wood and plywood plates in terms of elastic constants, dimensions and density. For supported edges, the solution is exact and gives the complete series of overtones. For clamped edges, the fundamental frequency is estimated by the approximate Rayleigh method, but evidence is presented which indicates that errors introduced by the use of the Rayleigh method are, in fact, negligible. A method of measuring the frequencies is described; comparison of calculated with observed frequencies shows that the former are on the average about 23 per cent. high for clamped edges and about the same amount low for supported edges. This discrepancy is attributed to lack of correspondence between the experimental edge conditions and those assumed in the theoretical treatment. Finally, an empirical method, based on the rough proportionality between elastic constants and density of wood, is suggested and justified for obtaining approximate estimates of the fundamental frequencies in terms of plate dimensions only. *Author's abstract.*

[1112]. 31.27 : 12.26–8 (728.6). GUTIERREZ B., F. Pruebas de resistencia de algunas maderas nacionales. **[Strength tests on some native woods.]** *Bol. pop. Dep. Agric. Costa Rica* No. 68, 1943. pp. [5]. [Span.]

Results of strength tests made on timber from ten indigenous hardwoods of Costa Rica. Tables show the fibre stress at maximum load and the working values expressed in kg. per sq. cm. and in lb. per sq. in. Timbers dealt with are:—*Quercus* spp., *Hymenaea courbaril, Bombacopsis fendleri, Pithecellobium saman, Cordia gerascanthus, Carapa slateri, Anacardium excelsum, Andira inermis, Tecoma chrysantha, Enterolobium cyclocarpum, Cedrela montana* var. *mexicana.* The specific gravities of air-dried specimens of these and eight other species are also given.

[1113]. 31.27 : 12.26–8. STERN, E. G. **Strength properties of Yellow Poplar from Virginia.** *Bull. Va. polyt. Inst.* 38 (2), 1944 (1–34 + tbls. + figs.) (*Engng. Exp. Sta. Ser.* No. 59).

[1114]. 31.27 : 31.45. MACLEAN, J. D. **Effect of heat on the properties and serviceability of wood.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1471, 1945. pp. 12 + tbls. + figs. P.R.

The woods used in these tests were Douglas Fir, Sitka Spruce, Yellow Birch, Yellow Poplar. The toughness and work-to-maximum load were the strength properties most affected in all tests described. In general the strength properties were affected in the following order, beginning with the one most affected: toughness and work-to-maximum load, modulus of rupture, modulus of elasticity, and fibre stress at proportional limit. No important effect on any of the strength properties of the different species occurred when the wood was heated in the hot press or oven for half an hour or less, even at a temperature of 320° F. Even in the longer heating periods up to 16 hours at 320° F., only the toughness and work-to-maximum load showed any marked reduction in comparison with the control specimens. A comparison of the results obtained with the different woods heated under the same conditions indicates that there was little difference between the effect on the two hardwoods, but that Sitka Spruce was somewhat less affected than Douglas Fir. Although a sufficient range of temperatures has not yet been used to establish the relation between temperature and its effect on the strength properties, the results indicate that this will vary according to some power function. *From author's summary.*

31.3. *Chemical Properties*

[1115]. 31.3 : 31.43 : 13.2. MARCHÁN, F. J. **The lignin, ash and protein content of some neotropical woods.** *Carib. For.* 7 (2), 1946 (135–38, 150). [E.Span.] [Agricultural Exp. Sta., Univ. of Puerto Rico.]

31.4. *Durability. Decomposition*

31.42. Attack by Plant Organisms

[1116]. 31.42.11 : 38.2. CAMPREDON, J. Les champignons du bois et les matériaux de construction. **[Wood-rotting fungi and building materials.]** *Rev. Archit. franç.* [1944] (597–8). [F.] *Abstr.* in *Rev. Eaux For.* 82 (6), 1944 (343–4).

The writer stresses the increased susceptibility of constructional timber to fungus attack when it is placed in contact with alkaline or hygroscopic materials. He cites two instances, one of a false ceiling supporting a filling of clinkers from a gasworks, in which, only 3 years after construction, the joists were rotted for almost their whole length, the clinkers were reduced almost to dust, and there was a slight smell of gas. All the affected wood showed characteristic *Merulius* rot, but also in places had the blackened appearance of carbonized wood. Enquiry revealed that the clinkers had been exposed to snow and rain before being put in position, and in the conditions of dampness and alkalinity thus provided, the fungus had developed rapidly and disintegrated the clinkers, thus probably releasing the sulphuric acid which had led to the superficial carbonization mentioned above. This phenomenon only occurred beneath tiled rooms, the moisture from the clinkers having been able to escape through the joints of parquet floors. It is concluded that filling materials such as clinkers, slag, or humus, capable of retaining moisture and of an alkaline constitution, should not be placed in direct contact with wooden beams and joists.

[1117]. 31.42.11 : 38.2 : 33.36.1. **Repair of damaged buildings. Eradication and prevention of dry rot.** *Build. Res. Note Dep. sci. industr. Res.* No. 9, 1945. pp. 5 + figs. P.R.

A general account of the conditions favourable to dry rot, ways of detecting and identifying it and recommendations for treatment. [Cf. *For. Abstr.* 7 (No. 259).]

31.43. Attack by Animal Organisms

See also *For. Abstr.* 8 (Nos. 1145, 1367).

[1118]. 31.43 : 12.25 : 13.2. MILLER, J. M. **Damage to Ponderosa Pine lumber and rustic poles by the black-horned Pine borer.** U.S. Bureau of Entomology and Plant Quarantine. No. E–599, 1943. pp. 9.

Damage to seasoned Ponderosa Pine lumber by a roundheaded borer, *Callidium antennatum* Newman var. *hesperum* Casey, is fairly common in the Pine region of the west where lumber is

seasoned or stored in open yards near Pine forests. This damage occurs only in lumber which has been sawn so as to leave strips of bark still adhering to the wood, and the most effective preventive treatment is total removal of bark. In the case of unbarked poles used for rustic work, nailing the loosened bark to the wood is a good practice, since no further damage is done after the inner bark has been thoroughly mined.

[1119]. 31.43 : 13.2 : 31.3 : 33.36.1. WOLCOTT, G. N. **Factors in the natural resistance of woods to termite attack.** *Carib. For.* 7 (2), 1946 (121–34, 139–49). [E.Span.e. span.f.] [Agricultural Exp. Sta., Univ. of Puerto Rico.]

Cellulose is readily digested by the enzymes of protozoa living in the digestive tracts of termites, while lignin is entirely undigestible. Thus woods with a high cellulose content have a high food value for termites, while they invariably avoid those with a high lignin content. In all timbers tested, the sapwood is more acceptable, since it contains starch and sugar, while the heartwood, which is also more lignified in many tropical hardwoods, is either avoided or not attacked until all sapwood has been consumed. Other constituents of wood, such as tannin, saponin, etc., are not usually present in sufficient quantities to have a deterrent effect. The most effective of the quinones tested are tectoquinone (beta-methyl anthraquinone), which is present in large quantities in East Indian Teak, much more than enough, in addition to a lignin content of 50 per cent., to account for its resistance to termites, and alizarin (1,2-hydroxyanthraquinone) of the madder plant. The wood of many tropical trees, of a few semi-tropical trees, but of no temperate-zone trees except Osage Orange [*Maclura pomifera*] and Southern Cypress [*Taxodium distichum*], is resistant or immune to the attack of *Cryptotermes brevis*. What natural resistance temperate-zone coniferous woods possess is due to their natural impregnation with specific resinous gums. Pine oil and its bulkier constituents volatilize rapidly, but chlorination of terpenes greatly increases, and makes more lasting their toxicity to termites. *From author's summary.*

[1120]. 31.43 : 31.3 : 13.2. CHAUVIN, R. Chimiotropismes des insectes. [**Chemotropisms of insects.**] *Ann. Épiphyt.* 11, 1945 (11–17). [F.] *Abstr.* in *Rev. Eaux For.* 84 (5), 1946 (276–7).

Ovipositing females of *Hylotrupes bajulus* are attracted to Pine and Fir by certain derivatives of turpentine, notably α and β pinenes. In the case of other cerambycids, such as *Ergates faber*, the two sexes are equally attracted by the pinenes.

31.44. Injury by Chemicals

[1121]. 31.44. VILLIÈRE, A. Résistance des bois aux agents chimiques. [**Resistance of woods to chemicals.**] *Chim. et Industr.* 52 (1–6), 1944 (97–108). [F.] D.S.I.R.

A general review is made of experiments carried out in America, England, Germany and France to test the chemical and physical action of certain chemical solutions on different species of woods, and some tabulated and graphical results are shown. Some French, French-colonial and other species are discussed with a view to estimating their suitability for making vats, etc., for chemical industries.

31.8. *Defects of Timber*

[1122]. 31.8 : 12.25 : 33.36.3. **Chemical brown stain in Pine.** *Tech. Note U.S. For. Prod. Lab., Madison* No. 254, 1946. pp. [2]. P.R.

The conditions under which chemical brown stain occurs in Pines and some established facts connected with its causes are briefly enumerated. Brown stain can be effectively prevented by cutting logs soon after felling. Since the substance or substances responsible for the stain are only moderately soluble in cold water, but are readily soluble in hot, its occurrence can also be limited by the use of mild temperatures in seasoning. As low a relative humidity as possible should be maintained in order to keep the zone of extractive concentration well below the surface. Brown stain develops less easily during air seasoning than in kiln drying, and thorough air seasoning before kiln drying will also reduce the likelihood of its appearance.

[1123]. 31.8 : 31.42.1 : 12.25 : 31.27. HANSBROUGH, J. R., and ENGLERTH, G. H. **The significance of the discolorations in aircraft lumber: Sitka Spruce.** *For. Pathol. spec. Release U.S. Dep. Agric.* No. 21, 1944. pp. 13 + tbl.

A survey was made of the discolorations occurring in Sitka Spruce wood, and toughness tests were made on specimens which had discolorations of unknown or doubtful significance. The study was made to aid inspection under U.S. Navy-Army Aeronautical Specification AN-S-6a, which does not enumerate all discolorations and blemishes. A description of the blemishes and toughness values of blemished wood, expressed as percentage of similar values for sound material, are given in the report. Blemishes which indicate no deficiency in toughness, or only a slight one, are:—included sapwood, vertical red streaks, radial red streaks or strawberry marks (unless accompanied by marked grain deviation or disturbance extending over one-fourth of the wide face), pitch pockets, seams and streaks (exception for limitations given in the above-mentioned specification), machine burn (unless deeper than 1/64 in.), brick-red stain, orange stain, surface moulds. Such wood (except where otherwise noted) is suitable for aircraft construction. Wood with the following blemishes should be rejected:—blue stain, yellow streaks, brown streaks and zones, brown spots, brown pits or pockets, white pits or pockets, zone lines. [Cf. *For. Abstr.* 7 (No. 1238).] *From authors' summary.*

[1124]. 31.8 : 31.42.1 : 12.26–8 : 31.27. HANSBROUGH, J. R., WATERMAN, A. M., and KRAUSE, R. L. **The significance of the discolorations in aircraft veneers: American Beech.** *For. Pathol. spec. Release U.S. Dep. Agric.* No. 16, 1944. pp. 6 + tbl. + figs.

Toughness tests were made on discoloured and clear specimens of American Beech rotary-cut veneer, in order to gain more information on defects and blemishes (some of which are listed in U.S. Army-Navy Aeronautical Specification AN-NN-P-511b) and their effect on the suitability of the wood for aircraft. The toughness of specimens with sap stain, brownish-yellow heartwood, pink heartwood, tan heartwood, worm streak, mineral streak and pith flecks was very little, if at all, inferior to that of pieces of clear wood from the same sheet of veneer. Other strength properties, such as extreme fibre stress in bending and maximum crushing strength in compression parallel to grain, would be expected to be reduced even less. Such discoloured material should prove satisfactory for aircraft. Material with sap stain accompanied by decay, brown incipient rot and decay in heartwood had very low toughness values compared with clear material from the same sheets of veneer. Such material would probably be low in other strength properties also, and should not be used for aircraft construction. Descriptions of discolorations and decays are given in the report, and tables show relative toughness values and specific gravities. *From authors' summary.*

[1125]. 31.8 : 31.42.1 : 31.27. SCHEFFER, T. C., and DUNCAN, C. G. **Breaking radius of discolored wood in aircraft veneers.** *For. Pathol. spec. Release U.S. Dep. Agric.* No. 22, 1944. pp. 4 + tbls.

The breaking radii of variously discoloured veneers of six different hardwood species were small enough, for most of the discolorations, to indicate that such veneers can be used successfully on members having curved surfaces. When expressed in terms of the minimum radius of curvature attained without fracturing, the breaking radius in nearly all cases was small enough to be amply covered by a minimum factor of safety of 3, as suggested in U.S. Specification ANC-19, Wood Aircraft Inspection and Fabrication. The only definite exception was veneer discolored by decay fungi. Some uncertainty as to suitability for sharply curved surfaces was indicated, however, for mineral streaks in Yellow Birch, for the dark reddish-purple variety of mineral stain in Yellow-poplar, and for gum streaks in Mahogany and Khaya.

[1126]. 31.8 : 33.15.1 : 07.7. LIMBACH, J. P. **A method of measuring checks in veneer.** *J. For.* 44 (7), 1946 (509–11). [U.S. Forest Products Laboratory, Madison.]

Description of a method of measuring depth of checks in rotary-cut or sliced veneers. The specimen is successively dipped in paraffin wax and indian ink, and then examined by means of a travelling microscope equipment with a cross-hair ocular, which enables measurements of both horizontal and vertical components (a and b) of the check depth to be made simultaneously. The average angle θ that the check makes with the surface of the veneer, and the actual depth c of the check can readily be found by simple trigonometry $\left(\theta = \arctan \frac{b}{a}\, c; = \frac{b}{\sin \theta}\right)$.

32. HARVESTING OF WOOD. LOGGING

[1127]. 32. ZEHNDER, J. Grundregeln der Holzhauerei. **[Fundamental rules of tree felling.]** Schweizerischer Verband für Waldwirtschaft, Solothurn. 1944. pp. 35. [G.] P.R.

[1128]. 32 (71 : 74) : 98.3. KNEELAND, P. **Problems of a hardwood operator discussed from a forester's point of view.** *Timber of Canada* 6 (5; 6; 7), 1945–46 (68–70; 86–7; 84–6).

The writer deals with operations in northern hardwoods, which have greatly increased in recent years, and especially with the differences between hardwood and softwood operations. The former require greater skill and judgment and special knowledge. Among the special difficulties are the weight of the hardwoods, which usually precludes rafting, the inaccessibility of many stands, the number of species involved, the very varied requirements of manufacturers, the low prices fixed by Timber Controls. Notes are given on sawing and stacking hardwood lumber and criticisms made of the hardwood lumber codes in both Canada and the United States.

[1129]. 32 (71.8). MCCRAW, W. E. **Pulpwood logging in central Newfoundland.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 835 (B–1), 1946. pp. 9.

The conditions in which pulpwood logging is carried on in central Newfoundland are briefly reviewed. Methods of logging and hauling are described. A graph gives the production per day of a single R2 tractor on a length of haul based on the averages of ten camps. The report ends with suggested improvements for the whole industry and an account of skidding experiments carried out by the Woods Department of the Anglo-Newfoundland Development Co., Ltd.

[1130]. 32 : 07.7 (75 : 76). KNAPP, G. E. **Mechanization in southern pulpwood logging.** *Sth. Pulp Paper J.* 9 (3), 1946 (30–4, 62).

The most outstanding mechanical development in Southern pulpwood logging in the past 5 years is the portable wheel-type circular saw, of which more than 4,000 are now operating in Southern pulpwood. Most of the wheel saws are used on the coastal plains but they are also becoming popular in hilly districts for crosscutting tree-length logs which have been skidded to decks. Nearly all makes of wheel saw are designed for both felling and crosscutting. Their use for felling is rapidly increasing. Felling crews of 2 or 3 men are often used. The extra man acts as guide in locating the next tree, determines its direction of fall, and carries a pike pole to push the tree over. Operators report that one wheel saw can fell 150 to 400 trees a day according to stand and ground conditions. Chain saws were not much used in the past, but with the increasing use of hardwoods for pulping there is a growing demand for them for use in felling small hardwoods in swamp or lowland types. Other recent developments are the portable rim circle saw and the one-man Sally saw, both of which employ the rim of a circular saw blade. Tractor-mounted saws driven by the power take-off have been used for several years in clearing brush from Texas grazing lands, but have not yet found application in pulpwood logging, though at least two companies have tried to use this equipment.

Tractor skidding of long logs is becoming a general practice. It makes accessible timber that a truck could not approach; it facilitates mechanical crosscutting and loading, and it minimizes the amount of manœuvring a truck has to do in the woods, thus reducing damage and costs of hauling equipment. Both wheeled and caterpillar tractors are used. Mechanical boom loaders and portable sawmills are used by some companies, but are still in the experimental stage. The bulk of pulpwood is hauled to the mills on standard 1½- and 2-ton motor trucks carrying 1½ to 2½ cords per load. A recent development in hauling is the use of industrial-type tractors and pneumatic-tyred wagons. This combination is intended to cover short hauls to the railway siding and it is believed that it will be capable of negotiating conditions in the woods in which an ordinary truck would be bogged down. [See also *For. Abstr.* 8 (No. 1139).]

[1131]. 32 : 07.7. SIMMONS, C. W. **Cutting and logging equipment for farm forestry work.** Extension Service, Agricultural and Mechanical College, Texas. No. B-137, 1944. pp. 19.

32.2. *Felling and Related Operations*

[1132]. 32.21 (74). **Guides for cutting timber in the northeast.** U.S. Forest Service. No. *AWI*-90, 1944. pp. 12. [Allegheny Forest Exp. Sta.]

A guide to cutting practices for six different types of forest to be found in the Eastern region of the U.S., giving simplified rules for estimating the growing stock, the percentage to be cut if cutting is justified, the relative value of, and labour expended on, small stuff, and the scaling of logs.

[1133]. 32.21 : 12.25 (74). **Guide for cutting Eastern White Pine.** U.S. Forest Service. No. *AIS*-7, 1945. pp. 8.

[1134]. 32.21 : 12.26–8 (74). **Guide for cutting Allegheny northern hardwoods.** U.S. Forest Service No. *AIS*-3, 1945. pp. 9.

[1135]. 32.25 : 07.7. Zehnder, J. Der Unterhalt der Sägen für die Holzgewinnung. **[The maintenance of saws for wood-cutting.]** Schweizerischer Verband für Waldwirtschaft, Solothurn. 1945. pp. 40. [G.] P.R.

[1136]. 32.25 : 07.7 (47.1). Aro, P. Die wichtigsten finnischen Scheitersägen und Äxte. **[The most important Finnish hand frame-saws and axes.]** *Intersylva* 1, 1940–1 (400–14). [G.e.f.it.span.]

Illustrated account of a survey of types in use in 1935.

[1137]. 32.25 : 07.7. **A power tool for the forest.** *Wood* 11 (7), 1946 (210).

Outline of the advantages of the Disson chain saw fitted with a Mercury air-cooled petrol engine. The tool is portable and can be used for all jobs for which a two-man crosscut saw is usually employed. The saw is capable of cutting a tree to within 4 in. of the ground, and every operation can be done with the engine in an upright position. A device in the tail stock handle automatically sets the chain to the required tension.

The light-weight, air-driven Disson pneumatic saw can be used for all timber-cutting jobs where a power supply is available.

[1138]. 32.25 : 07.7. Stovall, C. **Meeting difficult problems with power saws.** *Timberman* 47 (6), 1945–46 (84, 86).

Practical suggestions for safe handling of unusual trees, when felling by power saws. Points dealt with include two trees which have grown together to a height of 15 or 20 ft., trees with a bad lean, and dead trees.

[1139]. 32.25 : 07.7 (71). Megaw, W. B. **The application of power saws in eastern pulpwood logging.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 829 (B–7–c), 1946. pp. 4.

The paper deals with the introduction of mechanical sawing methods into the pulpwood industry of the Eastern region of Canada. The slasher, wheelbarrow and power-driven chain saws are discussed. An account is given of the problems of training, etc., which arose when two-man chain saws were introduced into British Columbia, and how they were overcome. [See also *For. Abstr.* 8 (No. 1130).]

[1140]. 32.25 : 07.7 : 82. Griffin, G. F. **Operating power chain saws.** *Aust. Timb. J.* 12 (2), 1946 (95, 97, 119). [National Safety Council, Chicago.]

An account of some of the special dangers arising from the operation of power chain saws for felling and crosscutting in the woods, with advice on how best to avoid accidents.

[1141]. 32.25.2 Boos. 'Der Zauberstab': ein Beitrag zur Fällungstechnik. **['The magic wand': a note on felling technique.]** *Forstwiss. Cbl.* 62 (5), 1940 (113–6). [G.]

If a small rod is inserted transversely into the undercut of a tree being felled, the falling stem will jump forward for a distance of 0·3–1·5 m. An explanation (diagrams) of this phenomenon is offered. Advantages are that the butt will come to rest outside the root spurs, thus facilitating subsequent manipulation and cross-cutting, but a caution is added that the direction of fall is less certain, and the stresses set up in the 'step' region may have effects such as the splitting of, or tearing out of large splinters from, the butt of the log.

[1142]. 32.25.2 : 07.7. **Giant shears for felling trees.** *Fibre Contain.* 31 (4), 1946 (30–2). P.R.

The new felling device developed by Mammoth Tree Shears Co., San Antonio, Tex., consists of shears attached to a standard track-type tractor. The shears, it is claimed, will cut softwood trees up to 30 in. diam. and hardwood trees up to 24 in., either flush with the ground, or leaving a stump up to 2 ft. high. Pressures of 30–60 tons on the shearing blades can be obtained. By correct manœuvring of the tractor, trees may be caused to fall on either side of it.

[1143]. 32.25.5 : 24.31. **Summary of Forest Products Laboratories' experiments on treating trees with chemicals to facilitate removal of bark.** *Woodl. Sect. Index Canad. Pulp Paper Ass.* No. 840 (B–7–d), 1946. pp. 3.

A summary of the results of experiments made by the Forest Products Laboratories, Ottawa, on treating standing trees with chemicals to facilitate the removal of the bark. It was found that a tree, killed by the use of chemicals during the season when bark is easily peeled, may retain its easy-peeling condition. The trees are girdled and a paste of water-soluble chemicals is applied to the exposed sapwood. The suitability of various chemicals is discussed, among them sodium arsenite, a mixture of arsenic trioxide and caustic soda, ammonium sulphamate, sulphamic acid and sodium chlorate. Their effectiveness appears to increase with the amount used. The arsenic compounds seem to give the best result, and they also prevent bark borers and, in heavy doses, discourage sapstain. The advantages and disadvantages of girdling and subsequent drying are discussed. The average weights per cu. ft. of four species standing a year after girdling are given. Drying may be unfavourable to easy peeling and appears to encourage sapstain and bark borers in some species. Logs may be soaked before peeling, and sapstain and insect attacks may be averted by chemical treatment. Another method is to treat the trees late in the season so that insects and stain-producing organisms have no time to establish themselves.

32.8. *Grading and Storage of Wood in the Rough*

[1144]. 32.81 : 12.26–8. SILVY-LELIGOIS, P. Deuxième étude sur les bois de qualité exceptionelle. Dénombrement des coupes de chêne comportant des bois de qualité: tranchage, merrains, ébénisterie. **[Second study of woods of exceptional quality. Enumeration of Oak cuts producing choice wood: sawlogs, stave wood, cabinetmakers' wood.]** *Rev. Eaux For.* 84 (6), 1946 (315–42 + plates). [F.]

In a previous article [see *For. Abstr.* 7 (No. 1833)] the author suggested a method of classifying and grading timber. The present article deals in detail with the grading of Oak.

[1145]. 32.82 : 31.43 : 13.2 (94) : 33.36.1. BRIMBLECOMBE, A. R. **Log storage of borer susceptible timbers.** *Aust. Timb. J.* 12 (4), 1946 (212–3, 239).

Yellow Carabeen (*Sloanea woollsii*) logs, which possess a very wide sapwood normally containing abundant starch, are liable to extensive *Lyctus* attack, and the log storage scheme here described was designed to give protection from this. The felled logs were moved from the bush to the storage dump without delay, and all loose pieces of bark were cut away to expose a fresh, clean surface. All exposed wood surfaces were immediately sprayed with a hot creosote emulsion (2 parts of 5-per-cent. soft-soap solution to 1 part of K55 creosote) and were finally coated with warm crude petroleum jelly. The powderpost beetle cannot attack through the bark nor through the petroleum jelly. Logs stored for 7 months showed no signs of *Lyctus* attack or end splitting after this treatment. In subsequent trials, logs of Yellow Carabeen and Brown Tulip Oak (*Argyrodendron trifoliatum*) were similarly treated (shortage of petroleum jelly made it necessary to use some crude lanoline) and, after storage for 10 months in one trial, and 22 months in another, remained free of *Lyctus* attack and serious end splitting. *From author's summary.*

32.9. *Transport*

[1146]. 32.91.1 : 82. HERRGEN, A. **A flow process chart analysis of pulpwood operations.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 850 (A–2–a), 1946. pp. 3 + figs.

The application of the flow process chart analysis methods (i.e. the graphic representation of all related work elements or factors connected with one process) to the pulp and lumber industries is considered. A skidding operation is taken as an example, and sample charts show one observed and one simplified method of carrying out a skidding operation.

[1147]. 32.91.12. **Single runner for skidding four foot pulpwood.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 842 (B–8–c), 1946. pp. 2 + fig.

An improved type of 'skidding runner' is described and illustrated and its merits discussed. The runner is curved at both ends, which are bored to allow for the passage of a

chain. The binder is placed in the centre of the chain and the load can be bound from this point. With this type of skidder unloading when the chain is not in tension can be avoided.

[1148]. 32.91.22 : 07.7. Olson, O. **Care of bulldozers—bulldozer equipment.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 846 (B–8–f), 1946. pp. 2. *Repr.* from *Marathon Courier*, April, 1946.

[1149]. 32.91.22 : 07.7. Scarlett, J. W. **Future crawler tractors for mechanized logging, with discussion.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 830 (B–8–f), 1946. pp. 6.

A discussion on the future of the crawler tractor in logging, and the nature of designs for its improvement, which are still in the experimental stage.

[1150]. 32.91.3. **Curadean portable pulpwood chute.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 847 (B–8–h), 1946. pp. [1]. [Canadian International Paper Co., Pentecost, P.Q.]

Figures illustrate various aspects of the chute, which has been used successfully for moving pulpwood on steep slopes. A 2-ft. opening in the bottom of the trough is helpful in clearing snow. In winter, softwood boards may be used. In summer, hardwood with a coat of oil or grease is necessary. In favourable conditions one man can handle up to 20 cords per day.

[1151]. 32.92–4. **Towing sinkers: 'asparagus' rafts solve problem.** *Timberman* 47 (7), 1945–46 (124–5).

Describes a system of bundling short logs for rafting purposes. These logs tend to sink if unloaded straight into the water, and, if made into flat rafts, cause heavy log losses. Satisfactory rafts can, however, be built of bundles of salvage or other short, heavy logs. Notes are also given on salvage of sunken logs.

[1152]. 32.92 : 38.5. Koroleff, A. **Canvas dams for river drive.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 844 (B–9–c), 1946. pp. 2.

An illustrated description of a temporary cable-post-canvas dam, which can be used by loggers to help to control spring waters. It can be used temporarily for heads of water up to 3 ft., or possibly 4 or 5 ft.

[1153]. 32.95. Stovall, C. **Jumping a spar tree.** *Timberman* 47 (8), 1945–46 (64).

A method of moving a spar tree, in its upright position, for a distance not exceeding 30 ft.

[1154]. 32.95 : 38.4. Poncet, A. Le débardage et la vidange des bois par les cables. [**The unloading and clearance of wood by cableways.**] *Rev. Eaux For.* 81 (2; 3), 1943 (37–44; 82–91). [F.]

A detailed description of the installation and operation of cableways for the transport of wood in the forest. French woodsmen are generally ignorant of the matter and have relied in the past on Italians to instal and work the cableways which are essential for logging operations in mountainous country.

[1155]. 32.95 : 38.4. Crestin, F. Téléfériques pour le transport des bois. [**Cable railways for the transport of wood.**] *Rev. Eaux For.* 82 (1; 2; 3), 1944 (21–31; 61–72; 121–35 + plates). [F.]

A detailed account of the principal types of cableway used for the transport of wood, their equipment and operation, illustrated by descriptions of some actual installations.

[1156]. 32.95 : 38.4. Crestin, F. Quelques dispositions particulières de téléfériques pour le transport des bois. [**Some special telpher arrangements for the transport of timber.**] *Rev. Eaux For.* 83 (9), 1945 (505–15 + plates). [F.]

A supplement to an earlier article [see previous abstract], giving details of some less usual types of cableway used for the transport of wood.

[1157]. 32.96. Michaud, J. A. **A pulpwood loading plant for rail shipments.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 838 (B–10), 1946. pp. 5 + fig.

A description is given of the construction of a pulpwood loading plant, which, at St. Felicien, Canada, handled 50,000 cords of 4-ft. pulpwood in a little over three months. An estimation of the percentage division of the operating cost of the plant is given, and points to be considered in constructing such a plant are enumerated and discussed.

[1158]. 32.96 : 07.7. Hasel, A. A. **The Blacks Mountain portable log loader.** *For. Res. Note Calif. For. & Range Exp. Sta.* No. 43, 1945. pp. 6 + figs.

Description of the features and operation of a portable log loader designed to facilitate light cutting, especially where trees susceptible to insect attack can be harvested before they are killed. The loader handles logs up to 38 ft. in length and up to 3,000 bd. ft. in volume. It is capable of making a direct-line lift of 12 tons. The estimated cost of the major parts, if purchased now, and the labour of construction is $3,686. Further information will be supplied on request to the California Forest and Range Experiment Station, Berkeley, Cal.

33. CONVERSION AND PRESERVATION OF WOOD

[1159]. 33 (43.1–5). GERMANY. **Technical industrial forest products developments in Germany.** *J. For.* 44 (6), 1946 (401–10).

Report on investigation for the Forest Products Subcommittee of the Joint Intelligence Objectives Agency. The targets investigated covered modified and improved woods, glues and plywood, engineering and wood structures, pulp and paper, wood preservation and seasoning, alcohol and yeast, forestry and sawmill equipment, and miscellaneous targets. The investigators' conclusions are roughly as follows. The forest stands in the 1937 area of Germany were not seriously damaged, the reported 50-per-cent. overcutting during the war years having been largely carried out under well controlled, sustained-yield cutting practices. Wood was not extensively used as a raw material for the development of new and improved products essential to war. During the war there were only two Bergius-process and three Scholler-process wood-sugar plants in Germany and all these were built or building before the war. German research and technological and industrial developments with forest products were, with few exceptions, considerably behind those of the United States. The following new or improved developments may prove of importance to United States wood industries and research in forest products. Improved technology for the rapid, continuous fermentation of alcohol or protein yeast for food from wood sugar. The development of a neutral resin adhesive (Polystal), reputed to be of high toughness, that sets at a comparatively low temperature. The development of techniques for the production of bleached Beech sulphite pulp of high alpha-cellulose content and its use for cellulose nitrate. The application of pre-hydrolysis to Pine pulp chips, followed by kraft pulping, and the production of a pulp used wholly for cigarette paper. The use of nitric acid for producing purified pulps of high alpha content. The experimental and reported successful use of resin-impregnated wooden retainers for high-speed ball and roller bearings. *From authors' summary.*

[1160]. 33 (66.7 : 66.9 : 728.2 : 88.1). ROBERTSON, W. A. **Developing the Colonies.** *Wood* 11 (7), 1946 (183–5).

Until recently, timber exports from West Africa and British colonies in the Caribbean have consisted largely of luxury or special-purpose woods. The growing importance of the plywood industry will probably result in a more complete utilization of mixed tropical forests, as tests have shown that for every two or three species suitable for the log-export trade, at least half a dozen can make plywood. Before attempting to set up plywood factories, much preliminary work will be needed on the testing of the suitability of available species and new valuation surveys taking into consideration the greatly increased number of saleable species. The biggest problem facing any prospective operator is transport, but this and other difficulties mentioned are not insuperable. Much of the timber available in tropical forests is good for everyday commercial use, but it can be profitably worked only by well planned up-to-date methods backed by sufficient capital.

[1161]. 33 (73) : 09.4. HANRAHAN, F. J. **Postwar availability and use of wood.** *Mech. Engng., N.Y.* 66 (10), 1944 (649–53). L.S.

Figures for the estimated distribution of sawtimber in the U.S. by regions and by species, the ratios of annual drain to growth by regions for sawtimber and cordwood in 1936, and timber removed from the U.S. commercial forests in 1936 are given. According to the latest U.S. Forest Statistics (1936–38) there are 630,000,000 acres of forest land in the country and the total stand of sawtimber is 1,764 billion board feet. A brief summary of new uses and technical developments in wood is given.

[1162]. 33 (77.4) : 32 : 09.4. **Wood utilization problems and possibilities in Michigan.** Michigan Planning Commission, Lansing, Michigan. 1946. pp. [iv] + 26. P.R.

Includes statistics of forest resources and wood-using industries in the State.

33.1. *Mechanical Conversion excluding the Manufacture of Mechanical Pulp*

[1163]. 33.1 : 07.7. HARRIS, P. **A handbook of woodcutting.** Forest Products Research Laboratory, Princes Risborough, Bucks. 1946. pp. 44 + plate.

This publication is intended to meet the need for a handy reference book to give adequate information on the many factors involved in sawing and machining operations. Mathematical aspects of the work have been omitted, as far as possible, but will be dealt with later in a separate work. Sections deal with reciprocating saws, circular saws, bandsaws, planing, moulding, tenoning, mortising, boring, turning. There are 21 text figures and 7 tables.

Use of Wastes

See also *For. Abstr.* 8 (Nos. 1228–9, 1235–6, 1238–40, 1280–1).

[1164]. 33.1 : 34.6. **A note on sawdust as a building material.** *For. Prod. News Lett. C.S.I.R. Aust.* No. 139, 1946 (2).

Notes on the methods and proportions for manufacturing Portland cement/sawdust floors, etc.

[1165]. 33.1 : 34.6 : 33.17. DUFFY, R. R. **Study of saw mill waste.** *Pulp Paper Mag. Can.* 47 (3), 1946 (276).

About 181 cu. ft. of wood in log form are furnished to a Canadian sawmill for the production of 1,000 bd. ft. of sawn timber containing about 94 cu.m. of wood. In an efficiently run sawmill operation, the 181 cu. ft. are distributed approximately as follows:—

1,000 bd. ft. merchantable timber	94 cu.ft.	or 52	per cent.
Slabs and edgings	58 „	„ 32	„
Sawdust	25·5 „	„ 13	„
Firewood and refuse	5·5 „	„ 3	„

In medium-size and larger mills it is customary to burn the sawdust in boilers equipped with Dutch ovens, from which enough steam is produced to furnish the necessary power for the operation of the mill. Until recently, the disposal of the slabs and edgings was a matter of expense, but the decreasing supply of wood for the paper industry has now made it economically possible to utilize this material. Some account is given of the methods of chipping now used in certain mills, with an average yield of about 0·35 ton oven dry, of chips per 1,000 bd. ft. sawn. Where the logs are barked before reaching the sawmill, the yield is 0·50 ton per 1,000 bd. ft. Good quality chips can be produced in standard chippers, but the present tendency is towards a smaller disk with multiple knives.

[1166]. 33.1 : 34.6 : 33.3. RUSSELL, J. K. **The utilization of wood wastes.** *Pulp Paper Mag. Can.* 47 (3), 1946 (277–9).

A review of the literature under three main heads: paper-making materials, oxalic acid, and alcohol. It is concluded that, under wartime conditions, shavings and chips would constitute a satisfactory substitute for esparto and other raw materials which were unobtainable, but that sawdust would not be found acceptable. It would appear unlikely, however, that such materials would find a permanent place as paper-making materials, partly because of the difficulties and expense involved in collection, and partly because of the inferiority of the pulp, particularly in cleanliness.

From the information available, it appears that, under the proper pressure conditions, oxalic acid may be produced from sawdust with hydrated lime. Yields may be somewhat lower than with alkali hydroxides, but this would be compensated by the lower cost of lime. A more serious objection is the necessity of operating under pressure.

33.12. Joinery, Turnery

[1167]. 33.12. STEVENS, W. C., and TURNER, N. **Bending wood by hand.** *Wood* 11 (4), 1946 (96–8).

Description of a simple method of hand-bending top rails for dining-chairs from woods such as Oak, Ash, Elm, Beech and Sweet Chestnut. The best method of rendering the wood plastic is by heating it to boiling point in a moist atmosphere (45 min. to each inch of thickness) in a steaming chest of a type described, made of almost any material not

affected by steam. Details are given of the actual bending operation and of the setting and drying treatment.

[1168]. 33.12. HAYCOCK, A. H. **Mortising methods.** *Wood* 11 (4), 1946 (111–3).

A discussion on methods of mortising, illustrating the use of the chain and the hollow chisel, or a combination of the two, in different types of woodworking. Suggestions are made for improving present methods and tools. [Cf. *For. Abstr.* 7 (Nos. 1850–1).]

[1169]. 33.12 : 07.7. HAYCOCK, A. H. **Standard boring tools.** *Wood* 11 (6), 1946 (170–2).

A discussion on the use and maintenance of a simple three-winged boring and slotting bit, a two-fluted bit, and a lip-and-spur bit.

[1170]. 33.12 : 07.7. HAYCOCK, A. H. **Special boring tools.** *Wood* 11 (7), 1946 (205–7).

A discussion on the uses and maintenance of the multi-spur bit, the shell bit, the two-fluted bit, the engineer's twist drill and some boring tools for special purposes, including the tubular saw and some combined tools for boring, counterboring and blocking holes.

33.15. Manufacture and Use of Veneers and Laminated Wood. Improved Woods. Laminated Materials other than Wood. Glues and Gluing

[1171]. 33.15 : 38.2. WANGAARD, F. F. **Recent developments in timber laminating.** *Timber of Canada* 6 (8), 1946 (56–7, 59–60, 63). [Yale Univ.]

A review of the uses and advantages of laminated timber for constructional purposes.

33.15.1. *Manufacture of Veneers and Laminated Wood*

See also *For. Abstr.* 8 (Nos. 1124–6).

[1172]. 33.15.1. BROSENIUS, K. H. **Improvements in or relating to laminated boards.** *Brit. Patent* No. 566,683 [*n.d.*]. Build. Sci. Abstr. 18 (6), 1945 (904). P.R.

The laminated board consists of two outer panels with intermediate members fixed between them. The intermediate members consist of simple and plane, individual, small pieces in the form of blocks, slabs, or bars, rigidly jointed to the two outer panels by gluing or the like, which, without being joined to one another, practically fill the space between the outer panels. The said pieces are so short that they have no appreciable tendency to deform the finished laminated board by warping.

[1173]. 33.15.1 : 31.8. STEVENS, W. C. **Distortion in timber with particular reference to laminated bends.** *Wood* 11 (6), 1946 (158–61).

A review of the more common forms of distortional degrade in solid timber and laminated bends, particularly in relation to moisture changes during drying, e.g. cupping, diamonding, springing, bowing and twisting. Geometrical considerations indicate that the extent of cupping depends mainly on the excess of tangential over radial shrinkage. Wood tends to shrink or expand in the direction of the annual rings, whereas movement in the direction of the grain (longitudinally) is relatively very small. [Cf. *For. Abstr.* 7 (1862).]

[1174]. 33.15.1 : 33.15.5. **Final report on laminated wood products. Pilot plant operations in development of processes for laminating lumber with phenol-type, low-temperature and synthetic glues.** Office of Production Research & Development, War Production Board, Washington. No. W. 238. 1945. pp. 87. D.S.I.R.

The first part of this report gives a general account of a project for the investigation, in conjunction with the Forest Products Laboratory, of methods of laminating White Oak for the production of shipbuilding timbers. The greater part of the report is occupied by detailed accounts of tests on the following subjects:—glue flake soaking; acidity of wood in tap water and saline solution; curing of phenolic glues; plasticity of Cascophen resin during cure at high temperatures; acetone extraction of glue films; X-ray diffraction as a measure of degree of cure of phenolic resins; use of aluminium cauls in curing resin adhesives in heavy laminated timbers; spacing of clamps on gluing jigs; gluing of scarf joints with radio frequency heating; absorption of copper naphthenate in dip treatment of skegs; gluing of Pine lumber treated with fire-retardant chemicals; strength of laminated Hickory shunt poles; permeability of resin glue lines to creosote; surface drying of laminated beams during

cooling; influence of size and character of defects on realized utility of lumber used for laminating; crushing strength of Maple/Pine aircraft carrier decking; gluing of Teak with resin adhesives; effect of heat on hygroscopicity of White Oak; laminating creosoted lumber with phenol resin glue; treating laminated timbers with creosote, etc.

[1175]. 33.15.1 : 33.8. **The manufacture of curved plywood.** *Aero Res. tech. Notes, Bull.* No. 41, 1946. pp. 2 + plates. P.R.

A description of a method of making curved plywood in a simple hydraulic press, with special reference to the manufacture of laminated plywood shoe soles.

[1176]. 33.15.1 : 33.91 : 12.25. **Western Hemlock plywood—commercial standard CS122–45.** U.S. National Bureau of Standards. 1945. pp. 14.

These rules cover 4 grades of moisture-resistant Western Hemlock plywood and a laminated board. In addition there are included prescriptions for tests, standard sizes, size · tolerances, reinspection rules, nomenclature and definitions.

33.15.2. *Use of Plywood and other Laminated Wood*

See also *For. Abstr.* 8 (Nos. 1296–7, 1300–3, 1311).

[1177]. 33.15.2 : 31.2 : 12.25. **Technical data on Douglas Fir plywood for engineers and architects.** Douglas Fir Plywood Association, Tacoma, Washington. 1942. pp. [85].

The publication contains the first 9 sections of a projected series giving technical data about Douglas Fir plywood, which will, when complete, form a permanent handbook for engineers and architects. These first chapters contain a description of Douglas Fir plywood, its manufacture and physical properties, types and grades etc., followed by detailed information about its strength properties, working stresses, etc. Charts showing the deflection of various types of plywood under uniform load are included. A chapter gives information on ways of preventing moisture condensation on walls and ceilings. The remaining sections contain data upon the thermal insulation properties of plywood, the lateral bearing strength of nailed plywood joints, the form factors of I and box beams with plywood webs, the design of flat panels with stressed covers and the design of built-up beams with plywood webs.

[1178]. 33.15.2 : 31.27. MARCH, H. W., NORRIS, C. B., SMITH, C. B., and KUENZI, E. W. **Buckling of thin-walled plywood cylinders in torsion.** *Rep. U.S. For. Prod. Lab., Madison* No. 1529, 1945. pp. 22 + tbls. + figs. P.R.

The report presents a theoretical analysis and the results of tests on the buckling strengths of thin-walled plywood cylinders in torsion. The theoretical analysis leads to the expression $r = k E_L \frac{h}{r}$ for the buckling stress, where h = thickness of the wall of the cylinder, r = radius of its median surface and E_L = modulus of elasticity of the veneers of the plywood measured parallel to the grain. The coefficient k is determined by the plywood construction, the direction of the face grain, and a parameter which is a function of the dimensions of the cylinder. Theoretical curves are presented that can be used to find the value of the constant k for a cylinder of given dimensions and type of plywood construction. Experimentally and theoretically determined values of k are considered to be in satisfactory agreement if allowance is made for the scattering of experimental values associated with imperfections of construction and material and for the lack of complete agreement between the elastic constants of major and minor test specimens. *Authors' summary.*

[1179]. 33.15.2 : 31.27. SMITH, R. C. T. **The buckling of plywood plates in shear.** *Rep. Div. Aeron. Coun. sci. industr. Res. Aust.* No. SM.51 [*n.d.*]. pp. 33 + tbls. + app. + figs. A.H.

Approximate solutions for the buckling of rectangular orthotropic plates under uniform shear are obtained by the Rayleigh-Ritz energy method. The results are shown in tables. An example illustrating the use of the results in calculating the critical shearing stress of a plywood plate is given in an appendix.

33.15.3. *Improved Woods*

See also *For. Abstr.* 8 (Nos. 1298–9, 1309–12).

[1180]. 33.15.3. KVALNES, H. M. (to E. I. du Pont de Nemours & Co.). **Treatment of wood.** *U.S. Patent* No. 2,398,649, Apr. 16, 1946. *Chem. Abstr.* 40 (13), 1946 (3866). P.R.

When wood is impregnated with freshly prepared aqueous solutions of some methylol-urea compounds, especially sesquimethylol urea, the wood is stabilized against dimensional changes induced by moisture and exposure after the impregnated wood is dried. The procedure used to treat the wood is described. Results are given in table form.

[1181]. 33.15.3. LUCE, F. **Delignified impregnated wood.** *Mech. Engng., N.Y.* 66 (10), 1944 (654–5, 657). L.S.

Thin wood veneers are digested by a modified sulphate process in order to remove the lignin but retain the original wood structure. They are then impregnated by immersion in a phenol-formaldehyde resin or other impregnant and dried. If dried slowly at low temperatures the product is extremely pliable. High-temperature pre-cures produce a wood of low specific gravity and good stability. After moulding, etc., the material is cured further before being ready for use. Birch and Mahogany are particularly suitable for pliable forms and Spruce, Western Hemlock and Douglas Fir for low-density types.

[1182]. 33.15.3. STAMM, A. J., and SEBORG, R. M. **Forest Products Laboratory resin-treated wood (Impreg).** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1380 (revised), 1943. pp. 9 + tbls. P.R.

[1183]. 33.15.3. STAMM, A. J., and SEBORG, R. M. **Forest Products Laboratory resin-treated laminated, compressed wood (Compreg).** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1381 (revised), 1944. pp. 12 + tbl. + figs. P.R.

Revision of an earlier pamphlet [see *For. Abstr.* 3 (227)].

[1184]. 33.15.3 : 31.27 : 31.22 : 31.45. ARMBRUSTER, F. Technische Mindestwerte für Kunstharzpresshölzer. **[Minimum technical standards for laminated, compressed wood impregnated with synthetic resins.]** *Holz* 3 (3), 1940 (78–82). [G.]

A discussion of properties and classes of this type of improved wood, with a tabular statement of suggested minimum values for strength properties, water absorption and heat resistance, and brief specification of test procedure for the properties in question.

33.15.4. *Laminated Materials other than Wood*

See also *For. Abstr.* 8 (No. 1291).

[1185]. 33.15.4. SHELMERDINE, H. N. (to Expanded Rubber Co., Ltd.). **Improvements in or relating to laminated materials.** *Brit. Patent* No. 574,448, Jan. 7, 1946. *Abstr.* in *Plastics* 10 (107), 1946 (209). P.R.

Laminated material consisting of an expanded rubber sheet faced on each side with a veneer. Between the rubber and the veneer Balsa wood is inserted.

[1186]. 33.15.4. KING, E. P. (to Wood Development, Ltd.). **A method of building-up composite walls, sheets or structures, containing veneer.** *Brit. Patent* No. 559,527 [*n.d.*]. Build. Sci. Abstr. 18 (7), 1945 (1153). P.R.

The method consists in arranging a number of sheets of light-weight timber or of plywood spaced apart by bars of comparatively rigid spacer material, such as Balsa wood, Spruce, plywood or the like, or comparatively flexible deformable spacer material such as cork, cork-composite, expanded vulcanite, vinyl acetate or the like, which bars may be in line or staggered, or by bars of the spacer material alternating with bands of very light-weight filling material such as calcium alginate foam, expanded vulcanite, or foamed or bubbled plastic or artificial resin, or by sheets of the said very light-weight filling material, securing these constituent elements together by adhesive to form a block (apertured or solid), then cutting up the block in known manner like a baulk of timber into slices or slabs straight, curved or tapered from edge to edge, which are suitable to be secured by adhesive between two external skins of veneer, plywood, plastic or metal.

[1187]. 33.15.4 : 12.26–8 : 31.2. MRAZ, E. A., and HUTCHINS, W. F. **Weight and dimensional stability of three low-density core materials.** *Rep. U.S. For. Prod. Lab., Madison* No. 1544, 1946. pp. 3 + tbl. P.R.

Balsa wood, Hycar and cellular cellulose acetate were immersed in liquids used in the maintenance of aircraft in order to obtain data on their changes in weight and dimensions in such conditions. The test liquids were isopropyl alcohol; ethylene glycol; 3580 oleo fluid, hydraulic (light petroleum) U.S. Specification No. 3580-c; 3586 oleo fluid, hydraulic (castor

oil base) U.S. Specification No. 3586–c Grade A-heavy; 100 octane gasoline; used crankcase oil; distilled water. Results of the tests are tabulated.

[1188]. 33.15.4 : 31.27. LANGHAAR, H., and FEFFERMAN, R. **Sandwich-type shear panels of wood-aluminium construction.** *Prod. Engng.* 16 (12), 1945 (841–4). L.S.

Equations are given for determining the shearing stress and buckling stress of the skins and core of a Balsa/aluminium-alloy sandwich panel. Tests results are given. The panels tested showed about 40 per cent. strength/weight advantage over stiffened sheet panels with beam sizes ordinarily encountered in aircraft structures.

[1189]. 33.15.4 : 33.32.4 : 31.27. ERICKSON, E. C. O., and BOLLER, K. H. **Strength and related properties of Forest Products Laboratory laminated paper plastic (Papreg) at normal temperature.** *Rep. U.S. For. Prod. Lab., Madison* No. 1319 (revised), 1945. pp. 13 + tbls. + figs. P.R.

The report presents the results of a series of tests made at ordinary room temperature and humidity to determine certain of the physical and mechanical properties of the high-tensile paper-base plastic laminate termed 'papreg', developed by the Forest Products Laboratory, Madison.

The tests included tension, compression, flexure, bearing, shear, hardness, loss of weight on drying, and water absorption of $\frac{1}{8}$-in. papreg, and compression, flexure, shear and impact strength of $\frac{1}{2}$-in. papreg. The appendix presents data on interlaminar strength, column strength, abrasion, linear thermal expansion, flammability, Poisson's ratios and directional properties of papreg. The data in the appendix are only indicative as they were obtained from a limited number of tests.

The investigations provide a measure of the isotropy of papreg, and show that the strength values of the laminates depend upon the orientation of the predominant direction of fibres in the constituent sheets of paper. The investigations also show that cross-laminated papreg is essentially isotropic in the plane of the laminations and, to a certain degree, has strength properties intermediate between those for the two principal directions of the parallel-laminated type. It is concluded that the material shows reasonable structural possibilities in all essential properties with, perhaps, the exceptions of impact resistance, compressive yield strength, and ductility. Papreg has a smooth hard surface, good resistance to abrasion and fire, and a specific gravity of about 1·4 at a resin content of about 36 per cent. [Cf. *For. Abstr.* 7 (No. 818).] *From authors' summary.*

[1190]. 33.15.4 : 33.32.4 : 33.3 : 34.6. **Lignin-filled, laminated-paper plastics.** *Paper Tr. J.* 122 (14), 1946 (35–42). P.R.

Methods of utilizing lignin to produce a laminated paper plastic with a high resistance to impact are described. The lignin used in experiments was produced from Aspen-wood soda-pulp black liquor in a pilot plant. The pulp may be mixed with an aqueous solution of the crude lignin, which is then precipitated in a water-insoluble form and suitable particle size by dilute sulphuric acid, or the lignin may be precipitated directly from its solution, when it becomes available, not only for use as a filler, but as a coating material for augmenting the lignin content of the surface of the lignin-filled sheet.

Six process variables in the construction of a lignin-filled laminate were studied: (1) lignin filler content, (2) type of sulphate pulp used; (3) use of lignin as a surface coating on the lignin-filled paper; (4) orientation of paper in lamination; (5) laminating pressure; (6) the use of special surface sheets to improve the resistance of lignin-filled laminates to water absorption. Tables show the varying physical and mechanical properties of the laminates. A comparison is made of the lignin-filled paper laminate with other laminated materials. Its physical properties appear to be equal or superior to the conventional type of paper-base laminate on the market, but, with the exception of toughness and impact, its strength values are lower than the papreg currently in development at the U.S. Forest Products Laboratory.

33.15.5. *Glues and Gluing*

[1191]. 33.15.5. EPPS, C. F. VAN. **Use of resins and glues for plywood and lamination.**—With discussion. *Rep. 4th Vermont Wood Prod. Conf.* 1944 (39–51). Vermont Bureau of Industrial Research, Norwich Univ., Vt. P.R.

[1192]. 33.15.5. ARNESON, G. N. **Glues and gluing in prefabricated house construction.** *Sth. Lumberm.* 172 (2164), 1946 (49–54). [U.S. Forest Products Laboratory.]

A review of wartime advances in the technique of glues and gluing and possible applications in the construction of prefabricated houses.

[1193]. 33.15.5. BRUMLEVE, C. C. **Industrial high frequency heat opens new markets to the wood products industries.** —With discussion. *Rep. 4th Vermont Wood Prod. Conf.* 1944 (20–37). Vermont Bureau of Industrial Research, Norwich Univ., Vt. P.R.

An account of the use of high-frequency dielectric methods of heating for plywood bonding. Methods and equipment are described, and the advantages of the process discussed. Its application to the production of compressed impregnated wood and to other types of wood-adhesive products are also dealt with. [Cf. *For. Abstr.* 8 (No. 1268).]

[1194]. 33.15.5 : 07.7. CUNNINGHAM, J. **Short wave welding gun aids laminating.** *Pacif. Plastics* 3 (12), 1945 (40, 42). [Short Wave Plastic Forming Co., Los Angeles, Calif.] L.S.

The author briefly discusses some of the problems involved in high-frequency wood welding and describes a new type of low-cost portable unit which can actually 'spot glue' without requiring expensive electrodes on each side of the glue line for curing, and which has sufficient power to polymerize the bonding resin through a panel of wallboard or plasterboard in five to ten seconds. Panels in building construction can be bonded directly to the studding by applying a synthetic resin with a plasticizer added for cohesive strength. No pressure is needed, and the strength of the bond is equal to that of the material. [Cf. *For. Abstr.* 7 (No. 1882).]

[1195]. 33.15.5. BENDER, F., and SCHNETZLER, K. **Laminated plastic, plywood, etc.** *Canad. Patent* No. 415,383 [*n.d.*]. Build. Sci. Abstr. 18 (7), 1945 (1076). P.R.

In order that the adhesive may be heated electrically, it is made electrically conductive by adding alkali compounds of fatty acids and higher alcohols, sulphonated fatty acids and their alkali salts, sulphonated oils and waxes, metal oxides or sulphides, etc.

[1196]. 33.15.5. LEFEBURE, V. (to Imperial Chemical Industries Ltd.). **Cementing of wood.** *Brit. Patent* No. 560,696, Apr. 17, 1944. Chem. Abstr. 40 (9), 1946 (2604). P.R.

Composite articles wholly or in part of wood are produced by applying to one or both of two surfaces to be joined, at least one of which is wood, an adhesive consisting of a $CaSO_4$ plaster gauged with an aqueous medium and containing urea-aldehyde syrup and, optionally, a filler. The surfaces to be joined are then brought together and held in contact until the adhesive has taken its initial set. The proportion of filler should not exceed the proportion of plaster, and the weight of resin solids should be between 0·25–0·75 of the weight of plaster and filler together.

[1197]. 33.15.5. MOWAT, E. L. R. (to Aero Research, Ltd., Duxford, Cambridge). **Improvements in or relating to synthetic resins.** *Brit. Patent* No. 574,095, Dec. 20, 1945. *Abstr.* in *Timber News* 54 (2083), 1946 (192). P.R.

An improved adhesive which consists of an aqueous, cold-setting, urea-formaldehyde resin, incorporating a comminuted cellulosic filler (e.g. wood flour, disintegrated wood pulp or powdered cotton) and an impregnating agent consisting of an aliphatic or alicyclic alcohol, aldehyde or ketone which is partially soluble in water and completely miscible with ethyl alcohol at ordinary temperatures. The adhesive, when used for making 'gap-joints', remains relatively free from cracking upon ageing.

[1198]. 33.15.5. **How a glue line made history.** *Plastics Newsfront* 1 (2), 1946 (14–7). D.S.I.R.

The development of Urac 183 and Urac 185, craze-resistant, waterproof bonding agents, suitable for assembly gluing, is described. They were developed by the American Cynamid Co. from the methods first used in fabricating British Beetle cements. Urac 185 is supplied in two components, a resin syrup consisting of a chemically modified urea-formaldehyde resin in water dispersion and a dry powder hardener. By varying the proportions of syrup and hardener the adhesive can be prepared with varying viscosities. Previous glues of this type have been too thick for use with a mechanical spreader. Quotations are made from the British Ministry of Aircraft

Production's report on the durability of Beetle cements in both tropical and temperate conditions.

[1199]. 33.15.5. **New plywood adhesive designed for high flour extension.** *Resin. Reptr.* 7 (1), 1946 (12–4). D.S.I.R.

A description of Uformite 501, a new urea-formaldehyde resin glue, particularly suitable for use with a flour extender.

[1200]. 33.15.5. Cone, C. N. (to M. & M. Wood Working Co.). **Resin-protein plywood glue.** *U.S. Patent* No. 2,389,183, Nov. 20, 1945. *Chem. Abstr.* 40 (8), 1946 (2355). P.R.

A weather-resistant bond is obtained by uniting plywood with a glue formed of a mixture of water-soluble phenol-formaldehyde resin and a protein glue. The assembly is cold pressed and the resin is cured in a drying oven at 160–225° F. To prepare the phenol-formaldehyde resin, 100 parts C_6H_5OH, 100 parts 40-per-cent. CH_2O and 5–10 parts NaOH are boiled for 30–90 minutes. Examples of protein glues are given, including a mixture of 300 parts H_2O and 100 parts soluble blood. A suggested blend consists of 60 parts of glue solids to 40 parts resin solids. The resultant bond will withstand boiling and exterior weather tests for plywood.

[1201]. 33.15.5. **Resorcin based adhesive.** *Brit. Plastics* 18 (200), 1946 (28). L.S.

A brief account of the properties of a new room-temperature-setting resin adhesive, Penacolite G–1215, produced by Pennsylvania Coal Products Co. [Cf. *For. Abstr.* 7 (No. 299).]

[1202]. 33.15.5. Olson, W. Z., and Cohodas, L. **Stability of low-temperature-setting phenol, resorcinol, and melamine resin adhesives stored at 80° F.** *Rep. U.S. For. Prod. Lab., Madison* No. 1532, 1945. pp. 5 + tbls. P.R.

A study was undertaken to determine the changes in certain properties during storage at room temperature, and to obtain information on the storage life of Glue A, Cascophen LT–67, Durez 12041, Resinox 230 and 840, Amberlite PR–75B, Lauxite PF–90 and 252, Penacolite G–1124 and G–1131, Melmac 400 and 401. A fresh sample of each was stored in a room at 80° F. and 30 per cent. relative humidity. At intervals, portions were removed, mixed and tested for working life at 75° F., equilibrium pH of the cured glue, non-volatile content of the mixed glue, insoluble content of the mixed glue, and dry and wet plywood joint strength. Results are discussed and shown in tables. The working life of the glue seemed to be the only characteristic significantly affected by storage and it is recommended that variation in working life should be taken as the criterion of the stability of a low-temperature phenol, resorcinol, or melamine glue.

[1203]. 33.15.5 : 31.27. Olson, W. Z. **Effect of closed assembly time on joint strength in gluing with low-temperature-setting phenol, resorcinol and melamine glues.** *Rep. U.S. For. Prod. Lab., Madison* No. 1535, 1945. pp. 4 + tbls. + figs. P.R.

Experiments were carried out to determine how various closed assembly times, with varied assembly temperature and clamping pressure, might affect joint strength. Glues used were: Amberlite PR–75B, Amberlite PR–245, Cascophen LT–67, Cascophen RS–216, Durez 12533–34B, Durez 12688, Lauxite PF–90C, Lauxite 252, Melmac 401, Penacolite G–1131, Resinox 230 and Resinox 840. Curing times and temperatures were those found by other tests to effect a high degree of cure in the particular glue used.

Hard Maple boards with approximately 12 per cent. moisture content were glued together in stacks of 6 laminations, each glue line having a different assembly time varying from long for the first to short for the last. Gluing and assembling were done at 70°, 75° or 90° F. Pressure was applied to the assembly at either 50 or 200 lb. per sq. in. Results of shear tests on the blocks are discussed and set out in tabulated and graphical form.

[1204]. 33.15.5 : 31.27 : 12.26–8. Bruce, H. D., Olson, W. Z., Black, J. M., and Rauch, A. H. **Development of joint strength in Birch plywood glued with phenol-, resorcinol-, and melamine-resin glues cured at several temperatures.**—With appendix. *Rep. U.S. For. Prod. Lab., Madison* No. 1531, 1946. pp. 4 + tbls. + figs. P.R.

A revision of an earlier bulletin [cf. *For. Abstr.* 7 (No. 297)].

33.17. Sawmilling and Machine Planing

[1205]. 33.17. L'entretien des lames de scies à ruban. **[The maintenance of band-saw blades.]** *Broch. tech. Serv. cent. d'Essais des Bois, Paris* No. 3, 1945. pp. 36 + plates. [F.] P.R.

[1206]. 33.17 : 07.7. HAASE, F., and DÖLLING, E. Neuzeitliche Hobelmaschinen. **[Modern planing machines [a review].]** *Holz* 3 (3), 1940 (82–90). [G.]

[1207]. 33.17 : 32.96 : 07.7. SIMMONS, F. C. **Methods of loading lumber at the rear of small sawmills.** *For. Prod. Note Ntheast. For. Exp. Sta.* No. 2, 1945. pp. 6.

Notes on several simple devices for speeding up work in small sawmills by reducing the bottlenecks of loading the finished timber. Two basic principles are used: (1) support for a load which protrudes from the mill deck, so that the trucks can back under it; (2) rollers on an inclined plane, so that the load can roll on to the truck, or be pulled down by trucks fitted with winches. [Cf. *For. Abstr.* 8 (No. 398).]

[1208]. 33.17 : 33.7. DONOVAN, T. **Notes on the construction and handling of small portable units for firewood cutting.** *Irish For.* 3 (1), 1946 (40–4).

33.3. *Chemical Treatment*

[1209]. 33.3 : 31.3. YORSTON, F. H. **Recent advances in the chemistry of wood.** *Pulp Paper Mag. Can.* 47 (3), 1946 (131–4).

This review of recent literature on the chemistry of wood covers North American publications appearing in the 12 months ending October 1945, together with some European work of earlier date.

Use of Wastes

See also *For. Abstr.* 8 (No. 1220).

[1210]. 33.3 : 34.6. MURDOCK, H. R. **Current developments in waste utilization.** *Industr. Engng. Chem.* (*Industr. Ed.*) 38 (5), 1946 (83–4). P.R.

Magnesium-base sulphite pulping is suggested as a solution to the problem of the recovery of waste liquors, since magnesium sulphate breaks down to the oxide rather than the sulphide when incinerated under reducing conditions. The concentrated liquor is sprayed by steam atomization into a boiler unit. The furnace maintains a reducing atmosphere in the first pass of the gases, and then more air is added to permit complete combustion of the organic matter. This method produces a highly reactive magnesium oxide and yields a high percentage of sulphur dioxide. Magnesium loss in the process is estimated at not more than 5 per cent. and sulphur loss at probably not more than 10 per cent. The organic content of the liquor is used as a source of steam for processing. [Cf. *For. Abstr.* 8 (No. 407).]

[1211]. 33.3 : 34.6 : 33.32.4. DANIEL, F. K. **Concentration and dialysis of waste pulp liquor.** *U.S. Patent* No. 2,201,812, May 21, 1940. Brit. Abstr. BII, 1946 (120). P.R.

A surface-active material is produced from waste wood-pulp liquor (e.g. waste sulphite Spruce liquor) containing colloidal complexes (I) of high molecular weight, by vacuum concentration of the neutralized liquor, followed by removal of Ca salts by precipitation, and of substances of low molecular weight by dialysis through a cellulosic membrane. The product contains (I) in substantially unchanged form, 15 per cent. of other solids, and 0·3 per cent. of sugars, and, when added in amounts from 0·65 per cent. to 0·75 per cent. (on weight of ZnO) to an aqueous paste containing 85 per cent. of ZnO, causes it to flow like heavy oil at slow rates of flow, but to behave like a solid at higher rates of flow. Addition of 0·04 per cent. of the product to dry cement clinker increases by 16 per cent. the specific surface generated by grinding the clinker. During dialysis the liquid flows across one side of the membrane while H_2O flows across the other, and each or either liquid may first be heated to 38–71°. Small amounts of NH_3 may be added to the H_2O. In the apparatus patented, a higher pressure head of H_2O than of liquid is maintained, and provision is made for stopping the flow if the membrane should break.

[1212]. 33.3 : 34.6 : 33.32.4. SCOTT, C. W. **Production of moulding composition from lignin and formaldehyde.** *U.S. Patent* No. 2,201,797, May 21, 1940. Brit. Abstr. BII, 1946 (135–6). P.R.

Such a composition is produced from the lignin contained in black liquor, by passing waste combustion gases through the liquor to

precipitate the lignin, which is then washed in acidulated H_2O, dissolved in aqueous NH_3, and treated with CH_2O to form a resin, which may be evaporated and ground.

[1213]. 33.3 : 34.6 : 31.3. KEILEN, J. J. **Pine-wood lignin.** *Amer. Paint J.* 29 (27), 1945 (55). [West Virginia Pulp & Paper Co., Charleston, S.C.] L.S.

A short description of the chemical properties of Pine-wood lignin, isolated from sulphate waste liquor, with suggestions for its uses. The chemical structure of Pine-wood lignin is still uncertain, but it is considered to be a polymer of many homogeneous units, having a unit weight of about 840 each, containing four methoxyl groups, four or more hydroxyl groups, and perhaps one carbonyl group. Although Pine-wood lignin is insoluble in water and most acids, it dissolves in many organic solvents. Films formed from solutions of Pine-wood lignin in higher boiling solvents such as diethylene glycol, appear to be very tough. Many of the esters and ethers of Pine-wood lignin are soluble in methanol alone, and such solutions leave films which are light in colour and elastic. Films of the esters of Pine-wood lignin and high-molecular-weight fatty acids are waxy in nature.

[1214]. 33.3 : 34.6 : 31.3. ADKINS, H. **Hydrogenation of lignin.** *U.S. Patent* No. 2,331,154, Oct. 5, 1943. Brit. Abstr. BII, 1946 (40). P.R.

Lignin is converted into products of low molecular weight, e.g. 4-propylcyclohexanol, 1 : 2-dihydroxy-4-propylcyclohexane, γ-(4-hydroxycyclohexyl)propanol, and higher-boiling glycols, by heating in an inert solvent, e.g. dioxan, with H_2 at 200–350°/150–400 atm. in presence of a Cu oxide or chromite catalyst.

[1215]. 33.3 : 34.6 : 31.3. LAUTSCH, W. Studien über Ligninsulfonsäure und über Ionenaustauscher auf Lignin-Basis. **[Studies of lignosulphonic acids and ionic exchange agents on a lignin basis.]** *Chemie* 57 (9/12), 1944 (78). [G.] D.S.I.R.

An account of investigations into the lignin content of sulphite waste liquor from Spruce pulp, which had been separated by fractional precipitation by the action of benzacridine into 9 fractions. Experiments to find a selective adsorbent, which would separate the lignosulphonic acids from the sulphite liquor in a concentrated form, and the use of ionic exchange agents on a lignin basis for this purpose are discussed. Investigations into the extraction and use of artificial resins capable of ionic exchange are also considered.

[1216]. 33.3 : 34.6 : 31.3. BRAUNS, F. E., and BUCHANAN, M. A. **The reaction between thio compounds and lignin.** *Paper Tr. J.* 122 (21), 1946 (49–52). P.R.

Hydrochloric acid Spruce lignin, fully methylated glycol Spruce lignin, Maple lignin and Beech lignin react with thioglycolic acid to form trithioglycolic acid derivatives. Spruce lignin reacts with butyl and benzyl mercaptans to form tetramercaptolignin condensation products. Hydrochloric acid Spruce lignin, when heated with a 10-per-cent. sodium sulphide solution at 170° C., is completely dissolved with the formation of thiolignin. *Authors' summary.*

[1217]. 33.3 : 34.6 : 31.3 : 12.25. BRAUNS, F. E., and LANE, W. H. **Thiophenol Spruce lignin.** *Paper Tr. J.* 122 (8), 1946 (38–40). P.R.

Black Spruce wood meal was heated with thiophenol in the presence of a small amount of HCl to form a mixture of thiophenol lignins, of which three (A, B and C) were isolated and purified. The ether-dioxane-insoluble thiophenol lignin A was methylated with diazomethane and with dimethyl sulphate, and was also acetylated. An analysis of the product is given. Isolated native Spruce lignin was suspended in thiophenol, and, with the addition of a small amount of HCl, dissolved. A thiophenol native lignin was isolated from the products and was also methylated with diazomethane. An analysis of the products is given. The dioxane-ether-insoluble thiophenol lignin A has four thiophenol groups, but only one hydroxyl group capable of methylation with diazomethane. The thiophenol native Spruce lignin has only three thiophenol groups.

[1218]. 33.3 : 34.6 : 31.3 : 33.37. SUIDA, H., and PREY, V. Über den Aufschluss von Säure-Lignin. **[The decomposition of acid lignin.]** *Ber. dtsch. chem. Ges.* 75 (12), 1942 (1580–4). [G.] P.R.

An account of further experiments on the decomposition of acid lignin. Lignin was heated with ethyl alcohol and calcium hydroxide to a temperature above 320° C., for more than

5 hours, producing 85 per cent. of crude tar or 65 per cent. of purified tar. An effective reduction of crude lignin tar was produced by heating it with decalin and tetralin. For comparison, crude lignin was heated with decalin, producing an incomplete decomposition of the lignin. An account of the experiments with analyses of the products is given.

[1219]. 33.3 : 34.6 : 31.3. JAYME, G. Wege zur Gewinnung und Verwertung der Hemicellulosen des Holzes. [**Ways of extracting and utilizing wood hemicelluloses.**] *Chemie* 57 (9/12), 1944 (78–9). D.S.I.R.

33.32. Pulp and Paper Manufacture. Wallboards. Plastics

See also *For. Abstr.* 8 (Nos. 1095, 1166).

[1220]. 33.32 (4). CAMPBELL, W. B. **Impressions of the European pulp and paper industry 1945.** *Pulp Paper Mag. Can.* 47 (3), 1946 (171–3).

During the war, most of the German sulphite mills were used for Beech sulphite pulp for making rayon staple fibre. Whereas coniferous waste liquor contains much hexose material which can be fermented to alcohol, waste liquor from Beech and other hardwood pulp has much less hexose and much more pentose, so that alcohol production is much reduced. But it was found that the hardwood liquors were suitable for the production of torula yeast which has a high protein value and may be used for food, so most of the mills went into food yeast production.

It has been generally considered that ordinary alkaline pulps are not suitable for rayons, but it was found in Germany that if, before the alkaline cook, the wood is cooked with dilute acid or even with water (which becomes acidic during the cook), the resultant pulp is readily bleached to produce a high-quality rayon pulp. This method has the advantage of complete consumption of the black liquor in the alkaline recovery process and so avoids the stream pollution inherent in ordinary sulphite production. At the same time the liquor from the dilute acid cook contains enough of the sugars to allow of economic fermentation to alcohol. Another interesting development is the making of pulp by cooking in nitric acid. This came about because one German chemical company had a large amount of by-product nitric acid of the appropriate strength. It was found to be very suitable for the production of cuprammonium rayon.

The writer was particularly impressed in Sweden by the great attention paid to cleaning wood, the widespread use of stainless steels, the great use made of engineering talent in the mills, and the importance attached to research.

[1221]. 33.32 (71). DUCHAUFOUR, P. Le bois de râperie et l'industrie du papier au Canada. [**Pulpwood and the paper industry in Canada.**] *Rev. Eaux For.* 81 (5; 6), 1943 (205–18; 269–79). [F.]

[1222]. 33.32 (75) : 09.4 : 32.2. MCCORMACK, J. F. **Pulpwood production and supply in Virginia and the Carolinas.** *Sth. Pulp Paper J.* 9 (4), 1946 (15–8, 31). [Appalachian Forest Exp. Sta.]

In the 5-year period 1940–44 the total quantity of pulpwood cut in the 3 States amounted to 11 million cords. As a result of the heavy drain on Pine stands, and the present methods of cutting Pine to a low diameter and leaving hardwoods standing, the ratio of hardwood volume is increasing and the area of pure Pine is being reduced by the invasion of hardwoods. This undesirable state of affairs might be mitigated by buying and selling on a basis of cords or units rather than on a lump-sum basis as at present. This would discourage overcutting by buyers and would enable landowners to reserve the unprofitable small trees. Increasing use of hardwoods for pulping processes is another possibility.

[1223]. 33.32 : 12.26–8. BRAY, M. W., and MARTIN, J. S. **High-yield sulfate and soda semichemical pulps from selected Southern hardwoods and Southern Yellow Pine for the production of paper boards.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1491, 1944. pp. 6 + tbls. P.R.

Seven Southern hardwoods of widely different physical and chemical characteristics, viz. Black Willow (*Salix nigra*), Southern Cottonwood (*Populus deltoides virginiana*), American Elm (*Ulmus americana*), Sugarberry (*Celtis laevigata*), Green Ash (*Fraxinus pennsylvanica lanceolata*), Bitter Pecan (*Hicoria texana*), Blackjack Oak (*Quercus marilandica*), and a sample of Southern Yellow Pine for comparison, were reduced to pulps of high yield by the

sulphate and the soda semichemical processes. For these experiments the customary pulpwood chips were digested with about one-half the total chemicals, at about half the concentration, commonly employed in the commercial operation of the sulphate process. As a result, the chemicals were almost completely consumed, and a high-yield product requiring disintegration and further refinement was obtained. These high-yield pulps were satisfactorily fiberized and refined either in a Bauer mill or in a beater and made into board suitable for corrugating. The sulphate semichemical pulps were higher in strength than those made from the same species with caustic soda alone. The sulphate semichemical pulp made from the less dense hardwoods had considerably higher strength properties than that made from the Southern Yellow Pine. The nine-point corrugating boards made on the laboratory Fourdrinier machine had satisfactory strength properties, comparing favourably with commercial Pine groundwood, Chestnut chip, and straw corrugating boards. [Cf. *For. Abstr.* 6 (33), 7 (No. 835).] *Authors' summary.*

[1224]. 33.32 : 12.26–8 (73). McGovern, J. N. **Possibilities of increasing the use of hardwoods to meet pulpwood requirements.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1614, 1946. pp. 6. P.R.

[1225]. 33.32 : 12.26–8. Fries, K. W. **Easily hydrating pulp from Poplar wood.** *Paper Tr. J.* 122 (21), 1946 (43–4). P.R.

A definition is given of an easily hydrating pulp, illustrated by results of beating tests of several easily hydrating pulps. It was found that bleached Poplar pulp prepared from mechanically refined chips cooked by the semichemical neutral sodium sulphite process as developed by the Forest Products Laboratory, Madison, is suitable for the production of high-density papers such as glassine. A good grade of glassine was made from 80 per cent. bleached Poplar and 20 per cent. bleached Spruce on a commercial paper machine.

[1226]. 33.32 : 31.1 : 31.23 : 56.02 : 12.25. Johansson, D. Über Früh- und Spätholz in schwedischer Fichte und Kiefer und über ihren Einfluss auf die Eigenschaften von Sulfit- und Sulfatzellstoff. **[On early and late wood in Swedish Spruce and Pine and their influence on the properties of sulphite and sulphate pulp.]** *Holz* 3 (3), 1940 (73–8). [G.g.]

In Spruce, weight increases and annual ring breadth decreases with an increasing percentage of late wood, but though the last-named is higher in the butt than in top logs, weight of wood is fairly independent of position in the stem. In Pine the same relations are true, except that poor correlation was found, especially for topwood, between percentage of late wood and ring breadth, and that the weight of buttwood is much higher than that of topwood.

Wood with a high percentage of late wood yields pulp of higher tearing strength but lower bursting and tensile strengths than that with a high proportion of early wood, the differences in strength being more marked in sulphate than in sulphite pulps. The sorting of pulpwood by rules based on annual ring breadth and position in the tree thus appears economically promising, especially in the case of sulphate pulping and where the tearing strength of the pulp is important.

A preliminary investigation of Pine from thinned plots in Ångermanland showed that the proportion of late wood had remained almost unchanged after thinning, the weight of the wood had decreased by 7–10 per cent. only in trees whose annual rings had increased 2 or 3 times in breadth, and the strength properties of sulphate pulp from the new wood were normal. It would thus appear possible to maintain the quality of the wood for sulphate pulping in spite of a considerable rate of increment in the trees.

[1227]. 33.32 : 31.3. Limerick, J. M., and Corey, A. J. **The relation of the chemical composition of fibres to their papermaking properties.** *Pulp Paper Mag. Can.* 47 (4), 1946 (62–4, 84).

A critical review of the literature is given, to show the present knowledge of the relation of physical and chemical properties. The general fibre structure is described, with particular emphasis on the location of the chemical constituents. Evidence shows that lignin has an adverse effect upon strength properties. High alpha-cellulose seems to be desirable for permanent types of paper, but other relationships are obscure. Hemicellulose appears to be necessary for hydration and a direct relationship between hemicellulose and strength is

indicated. Viscosity is also shown to be related to papermaking qualities, but its effect is complicated by the hemicellulose content. Certain relationships between physical and chemical properties are clear, but the need for much more fundamental work is stressed. *From authors' summary.*

[1228]. 33.32 : 34.6 : 33.17. KINCAID, D. H. **Conversion of wood waste to useable fibre with the Bauer refiner.** *Pulp Paper Mag. Can.* 47 (3), 1946 (195–202).

Samples of sawmill sawdust, shavings and scrap softwood (mechanically reduced in size) were defibred, using a Bauer pulper. A series of 5 pulper runs was made with each material to determine the effect of operating variables on the production rate and characteristics of the pulp produced. Each material was defibred (1) without pretreatment, (2) following a mild water cook (50 lb. pressure for 30 minutes), and (3) following a severe water cook (100 lb. pressure for 1 hour).

Pulps obtained were compared with a coarse groundwood pulp having an average burst factor of 4–25 at from 350 to 450 freeness. None of the sawdust pulps equalled the groundwood. Shavings steamed at 100 lb. pressure before reduction produced a pulp as good as the groundwood. Pulp produced from scrapwood by direct reduction was marginal in quality. Pulps produced from scrapwood steamed before reduction were much stronger than coarse groundwood. Pulps from material steamed before reduction were dark in colour, resembling kraft pulp. Tables giving power requirements, pulper settings and stock characteristics of the pulps obtained are included. *From author's summary.*

[1229]. 33.32 : 34.6 : 33.17. CHURCH, J. W. **Fibre from waste wood.** *Pulp Paper Mag. Can.* 47 (3), 1946 (275).

The purpose of this study was to produce a fibre from sawmill and planer mill waste suitable for use in boxwood, wallboard and other coarse papers. The results obtained by the Asplund process were, in the author's opinion, good enough to indicate that a percentage of this fibre would be of advantage to makers of boxboard and other coarse papers. The results of the experiment (using Spruce and Balsam shavings, chips, and sawdust in varying proportions) are given in tabular form.

33.32.1. *Pulp Manufacture*

[1230]. 33.32.1. JOHANSON, G. C. E. **A few predominant problems in acid pulping and their sources.** *Paper Tr. J.* 122 (23), 1946 (29–30). P.R.

The paper emphasizes the fact that clean high-grade pulp can be produced only from wood which is sound and clean, and as uniform as possible. General recommendations are made on ways of making the best use of pulpwood grown in the United States.

[1231]. 33.32.1 : 07.7. OSCARSON, G. L. **Application of motors to chippers.** *Paper Ind.* 27 (10), 1946 (1519–21, 1529). P.R.

Types of installation for the motor driving of chippers are described and listed, and the advantages of the synchronous motor and the high slip squirrel-cage motor are discussed.

[1232]. 33.32.1 : 12.25. EVANS, J. C. W. **Sulphite yield from wood.** *Pulp Paper Mag. Can.* 47 (4), 1946 (55–7).

A questionnaire on sulphite yield was sent out to 45 Canadian and Newfoundland sulphite mills, and 12 sulphite mills in the United States. The data thus obtained are summarized, and from them and the literature, the following conclusions are drawn. High total SO_2 and higher combined SO_2 can give increased yield, but this is expensive as it means loss of sulphur in the waste liquor. Soaking, pre-circulation, and circulation during cooking, all tend to improve the uniformity of conditions in the digester and to prevent local over- or under-cooking, and thereby increase the yield. The initial temperature, method of approach to the maximum temperature, and time at maximum temperature all have a direct bearing on yield. The lowest practicable maximum temperature and the shortest time taken to reach it will give the highest yield and better pulp for most purposes. Partially rotted wood gives a lower yield. Fluctuations in density in any one species are said not to affect the yield. There are indications that different species give different yields and the following are arranged in decreasing order of yield: Black Spruce, White Spruce, Balsam Fir, Jack Pine, Hemlock. Higher bleachabilities will produce higher yields, but this point is often overlooked in mills where bleachability of pulp has no other significance. It should be possible, with care, except in the lower range of bleachabilities, to

produce most grades of sulphite pulp at 50 per cent. yield.

[1233]. 33.32.1 : 12.25. MARTIN, J. S. **Production of bleachable sulphate pulps from rapid-growth Douglas Fir.** *Paper Tr. J.* 122 (22), 1946 (37–44). P.R.

Unbleached sulphate pulps of medium bleach requirement and good strength qualities were produced by treating rapid-growth Douglas Fir with cooking liquors of 33·9 and 50·6 per cent. sulphidity. Bleachable pulps were obtained in this way, using the same time and temperature conditions which are normally employed for producing ordinary kraft pulps.

Multi-stage bleaching experiments involving different chlorine partitions gave bleached pulps high in whiteness but variable as to strength. The higher sulphidity pulp seemed to bleach a little more easily than the lower sulphidity pulp although the bleaching conditions were not exactly the same. At each sulphidity a bleached pulp was obtained which had a very good colour, a fairly high alpha-cellulose content, a low ash content, and strength values apparently high enough for use in white papers requiring high strength properties.

Bond papers with a high degree of whiteness and a good formation were made. Such qualities as porosity, opacity, and gloss were satisfactory, but considerable strength was lost in converting the pulp into paper. *From author's summary.*

33.32.3. *Fibreboards*

See also *For. Abstr.* 8 (No. 1229).

[1234]. 33.32.3. GAUTHIER, J. H. **Felted wood fiber machinable cork-substitute material.** *U.S. Patent* No. 2,395,218, Feb. 19, 1946. *Paper Tr. J.* 122 (19), 1946 (45). P.R.

The material contains about 80 per cent. of substantially acid-free coniferous fibres (about $\frac{1}{8}$ to $\frac{3}{8}$ in. long and containing all the lignin and natural incrustations) and 20 per cent. partially hydrated chemical wood pulp.

[1235]. 33.32.3 : 33.32.4 : 34.6. **Plimber. Utilizing waste materials with aid of synthetic resins.** *Brit. Plastics* 18 (201), 1946 (82–4). L.S.

A plastic product with the trade name 'Plimber', primarily a constructional material for walls, partitions and floorings, has been producted by British Plimber Ltd., London. Made from sawdust, straw and other raw materials, chemically treated and bonded with synthetic adhesives, it is suitable for mass production in a comparatively low-cost plant. Details of size, density and properties of the boards produced are given.

33.32.4. *Plastics*

See also *For. Abstr.* 8 (Nos. 1189–90).

[1236]. 33.32.4. LOUGEE, E. F. **Plastics from farm and forest.** Plastics I.T. Institute, 221 La Salle Street, Chicago, Illinois. 1943. pp. ix + 159.

The book gives a general review of developments in the plastics industry since the first synthetic plastic was made in 1869. Various sources of plastic materials—wood and cotton, hulls and shells, soybean, coal, etc.—are reviewed and the many plastic products are illustrated by typical examples. A chapter is devoted to lignin from wood waste.

[1237]. 33.32.4. SCHWARTZ, S. L., PEW, J. C., and MEYER, H. R. **Low-resin-content and resin-free pulp plastics.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1483, 1945. pp. 5 + tbls.

Experiments at the Forest Products Laboratory, Madison, have demonstrated that moulded plastics can be made from high-yield wood pulps in which little or no phenolic resin has been incorporated. A comparison of plastics so made with pulp plastics containing as much as 40 per cent. of phenolic resin by weight indicated some loss of ultimate tensile and compressive strength and lowered resistance to water absorption, but improved toughness. The most promising of the plastics containing no resin appeared to be those produced from pulps obtained by milling water-cooked chips. By coating the surface of the pulp mats with resin before moulding them, their water resistance was considerably improved. Plastics of moderate strength and good water resistance were also produced by the addition of small amounts of water-soluble phenolic resin or non-phenolic resins. [Cf. *For. Abstr.* 7 (No. 1307).] *Authors' summary.*

[1238]. 33.32.4 : 34.6. BAYON, H. P. **Molded articles from waste wood products.** *Brit. Patent* No. 562,582, July 7, 1944. Chem. Abstr. 40, 1946 (501). P.R.

Waste woody matter, such as hardwood chips, cuttings and shavings, is heated to about 65 to 80° C. to eliminate the surface moisture, and is then charged into a jacketed sprayer, where it is sprayed with a mixture composed of a solvent for the natural resins in the wood (e.g. xylol) and a small proportion of a polymerizable phenolic or cresylic resin condensate. The product is mixed and conveyed to a heated container where the xylol, softening the wood surface, acts as a solvent for the wood resins and helps to carry the artificial resin condensate into the pores of the wood. Measured quantities of the product are charged into moulds and shaped under heat and pressure. [Cf. *For. Abstr.* 6 (177, 187).]

[1239]. 33.32.4 : 34.6. BAYON, H. P. **Molding powders.** *Brit. Patent* No. 562,590, July 7, 1944. Chem. Abstr. 40, 1946 (501). P.R.

Sawdust or wood flour is dried until its moisture content is approximately 9 per cent. To it is added ground condensate flash or sweepings or other fillers if required. It is then mixed with a hot partly condensed resin, capable of being further polymerized by heating. A cresol-formaldehyde condensate is preferred. The wood flour, etc., and liquid condensate are mixed while being heated, during which process steam and gases are formed and must be allowed to escape from the mixer. The mixture is dried and reduced to powder or pellets. The product is resistant to attack by acids and cold alkalis at commercial strengths.

[1240]. 33.32.4 : 34.6. GUSS, C. O. **Acid hydrolysis of waste wood for use in plastics.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1481, 1945. pp. 12 + plates + figs. P.R.

This report is intended to replace the information and recommendations given in a previous report [*Mimeo. U.S. For. Prod. Lab., Madison*, No. *R*1209] on acid-hydrolysed wood, to present new and more complete data on hydrolysed-wood moulding powders, and to describe procedures for making laminated sheets and boards from hydrolysed wood.

33.33. Manufacture of Textiles from Wood

[1241]. 33.33 (43.1–5). WICKER, D. B. **Continuous viscose making at the I.G. Farbenindustrie, A.G. Wolfen.** [*Rep.*] *Comb. Intell. Obj. Sub-comm.* Item 22, File XXX–23, 1945. pp. 7. P.R.

This plant, having a capacity of 60 metric tons per day, was found to be substantially undamaged but out of operation. Half the capacity is steeped in conventional presses and half by a continuous steeping process utilizing flake Beech pulp containing 55 to 60 per cent. moisture and 88 per cent. alpha on the dry basis, a moist pump, steeping in the form of slush stock and pressing by means of screw presses. The ageing of alkali cellulose is done continuously i. rotary drums. Xanthation, solution and ageing is batchwise. *Author's abstract.*

33.34. Dyeing and Bleaching of Wood

See also *For. Abstr.* 8 (No. 1269).

[1242]. 33.34. BAYMILLER, J. W. (to A. G. Spalding & Bros., Inc.). **[Bleaching] treatment of wood.** *U.S. Patent* No. 2,203,589, June 4, 1940. Brit. Abstr. BI, 1946 (103). P.R.

The wood is treated with a 3- to 30-per-cent. solution of H_2O_2 until bleaching has penetrated only deep enough to allow for the wood removed on final finishing of the surface; an alkaline atmosphere (NH_3) increases the bleaching effect, and wetting agents may be present. The bleached wood is washed in H_2O to prevent subsequent discoloration; drying is effected in the presence of $(CH_2 \cdot OH)_2$ to prevent checking.

[1243]. 33.34. ALLEN, L. R. VAN. **Wood impregnation [for bleaching purposes].** *U.S. Patent* No. 2,205,770, June 25, 1940. Brit. Abstr. BI, 1946 (103). P.R.

The naturally soluble material in wood logs is displaced longitudinally by forcing in bleaching liquid at one end. The necessary pressure may be generated by causing the liquid to evolve gas by means of a catalytic agent which will react with the peroxide or other bleaching agent.

33.36. Preservation of Wood. Seasoning and Drying

[1244]. 33.36. CLARKE, W. J. (to Bell Telephone Laboratories Inc.) **[Quick-drying]**

wood filler. *U.S. Patent* No. 2,194,295, March 19, 1940. Brit. Abstr. BII, 1946 (98). P.R.

The composition comprises SiO_2 (or other siliceous material) (I) (c. 50 per cent.) and an impalpable dehydrated amorphous SiO_2 (c. 12 per cent.) prepared from SiO_2 gel, substantially finer than (I), and forming c. 20–30 per cent. by weight of the SiO_2 present in the filler. A quick-setting varnish (proportions for a typical composition are given), a little Al stearate, and suitable solvents may be included.

33.36.1. *Preservation against Attack by Plants and Animals*

See also *For. Abstr.* 8 (Nos. 1145, 1367).

[1245]. 33.36.1. DEDIEU, M. Procédés modernes de conservation du bois. **[Modern processes of wood preservation.]** *Rev. int. Bois* 13 (106), 1946 (75–7). [F.]

A review of some of the principal methods of preservative impregnation of sleepers and poles. The processes reviewed are those of Boucherie (or Osmose), Kyan, Estrade, Dessemond, Rüping, Poulain, and Bethell.

[1246]. 33.36.1. LANE, C. J. **Timber preservation by impregnation with creosote under pressure. Pre-treatment machining: process of incising: operating methods: special features of plant.** *Commonw. Engr.* 33 (8), 1946 (273–81). L.S.

[1247]. 33.36.1 : 31.42.12. HARTLEY, C. **Sap-stain control treatments before or after dressing?** *Sth. Lumberm.* 172 (2165), 1946 (77). [Division of Forest Pathology, U.S. Bureau of Plant Industry, Beltsville, Md.]

Dipping or spraying of green lumber with stain-control chemicals has been reported recently [cf. *For. Abstr.* 7 (No. 1923)] as valuable for preventing or delaying stain and decay infection in bulk-piled lumber, but it should be remembered that the chemicals do not penetrate to any great depth, and are mostly removed by planing. If green lumber is dressed within 3 days of sawing, dipping or spraying should be done as it comes from the planer. If the dressing is done more than 3 days after sawing, but while the lumber is still green, the best course would be to treat it directly after sawing and again after dressing.

[1248]. 33.36.1 : 31.42.12 : 33.31. VOORHIES, G. **Are you ready for sap stain?** *W. Cst. Lumberm.* 73 (4), 1946 (89).

A recapitulation of general precautionary measures in air-drying yards. Chemical dips for sap stain such as Lignasan, Dowicide or Santobrite give excellent results. New developments of the chlorophenolates with borax and/or soda (such as Permatox 10S and Noxtane) give cheaper treatments than the former standards and better control of stain and mould.

[1249]. 33.36.1 : 31.42.12 : 33.31. HILL, E. F. (to Wyandotte Chemical Corp.). **Preservative composition.** *U.S. Patent* No. 2,392,987, Jan. 15, 1946. Chem. Abstr. 40 (10), 1946 (2928). P.R.

Sap stains and mould growth in green hard- and softwoods are prevented by a preservative prepared from alkali salt of a halogenated phenol, Na pentachlorophenate, $Na_2B_4O_7 \cdot 10H_2O$ and modified soda, e.g. $Na_2CO_3 1 \cdot 6NaHCO_3 \cdot 2H_2O$.

[1250]. 33.36.1 : 33.31. MCFARLAND, W.A. **The fungicidal properties of DDT.** *Sth. Lumberm.* 172 (2163), 1946 (48).

Experiments were made to test the toxicity of DDT on *Fomes annosus*, *Lenzites trabea*, *Trametes serialis* and *Poria incrassata*. Concentrations of 3–4 per cent. of DDT are required for complete inhibition of growth. Standard wood preservatives now in use have an inhibition point of less than 0·5 per cent. Thus DDT treatment, to compare with current commercial treatment, would require retentions of about 25 lb. of DDT per cu. ft. of wood, which are impossible to obtain. The costs of the material and of a suitable solvent likewise prohibit DDT from being used as a wood preservative.

[1251]. 33.36.1 : 33.31 (410). GREAT BRITAIN. **Classification of wood preservatives.** *Brit. Stand.* No. 1282, 1945. pp. 8.

No acceptable tests to assess the penetrating power and permanence of a wood preservative have yet been devised in Great Britain, and therefore the preparation of a British Standard on general lines has been temporarily abandoned. As a general guide, however, a classification of wood preservatives under three types is made. These are:—tar-oil types (including coal-tar creosote), organic-solvent types and water-solution types. An appendix

gives the B.S. method of test for toxicity to fungi, with which all wood preservatives should comply. A note on methods of application and use is also included.

[1252]. 33.36.1 : 33.31 (43.1–5). GOTTSCHALK, F. W. **Coal-tar creosote for wood preservation during the war period.**— With appendix. *Fiat Final Rep. Brit. Intell. Obj. Sub-comm.* No. 478, 1945. pp. [8] + 4. P.R.

Investigations into the principal creosote firms of Germany showed that no technical work in connexion with creosote was undertaken by the coal-tar industries during the war. Restrictions set by the German Government upon the use of creosote for wood impregnation resulted in all German wood-impregnation plants changing over to a salt type of preservative, such as Flunax, which was essentially sodium fluoride. Laboratory studies of a minor nature were undertaken, but no data are available. In one of these investigations sleepers were first pressure-treated with a water-soluble salt and then immediately retreated with creosote. Another experiment aimed at finding a means of impregnation with coal-tar pitch by the use of a solvent solution and a process to extract and recover the solvent. *From author's summary.*

[1253]. 33.36.1 : 33.5 : 31.41. WHITNEY, C. N. **Results to date of studies of the durability of native woods treated and untreated.** *Sta. Pap. Nth. Rocky Mt. For. & Range Exp. Sta.* No. 5 (revised), 1946. pp. 54. P.R.

For more than 30 years, service records for native woods used as fence posts, pole stubs, poles, railway sleepers and mine timbers have been kept by the U.S. Northern Rocky Mountain Forest and Range Experiment Station. Preservatives used were zinc chloride, Anaconda Wood Preservative (arsenic trioxide) in dust, granular and paste forms, sodium fluoride, tetrachlorphenol, Lodgepole Pine pitch and coal-tar/creosote or creosote/petroleum-oil mixtures. The paper includes final summaries for all closed tests and latest inspection results of studies still in progress.

[1254]. 33.36.1 : 33.53. GOLAZ, P. Étude sur la durée des poteaux en bois injectés. **[Study on the service life of impregnated wooden poles.]** *Rev. int. Bois* 13 (106), 1946 (78–81). [F.]

Comparative statistics are given for the life of treated telegraph poles from France, Switzerland, Germany, Austria, United States and Great Britain. It is concluded that a treated pole, with its butt end in the ground, lasts 3–5 times longer than an untreated pole.

[1255]. 33.36.1 : 33.54. TAMBLYN, N. **The preservative treatment of fence posts.** *For. Prod. News Lett. C.S.I.R. Aust.* No. 139, 1946 (1, 3).

Tests started in Western Australia in 1931–32, and continued over 16 years, have shown conclusively that many timbers regarded as unsuitable for round posts on account of low natural durability will give long and satisfactory service if treated by the following method. Posts should be barked and seasoned for several months before treatment in order to ensure good penetration. As creosote oil is simpler to use than chloride and arsenic, it is recommended that treatment be restricted to this preservative. The essential treating plant consists of one or more tanks and a thermometer with a temperature range up to 240° F. For butt treatment of normal-size fence posts, the most easily obtained tank is the ordinary 44-gal. oil drum.

Posts should be placed butt down in the drums and the height of the preservative adjusted to about 30 in. Treatment consists in heating the creosote oil for 2–4 hours (depending on the species to be treated) at a temperature of about 200–210° F., and then either allowing the posts to cool in the drum or quickly transferring to a second drum containing the same quantity of cold preservative. Immersion during cooling is the most important feature of this process, since absorption of preservative occurs as the post cools.

[1256]. 33.36.1 : 33.54 : 07.7. LORENZ, R. W. **A convenient method for cold-soaking fence posts in a pentachlorphenol solution.** *J. For.* 44 (7), 1946 (520–2). [Department of Forestry, Univ. of Illinois, Urbana, Ill.]

Specifications and costs for the construction of a simple plant to treat fence posts by the cold-soaking method are presented with brief comment on the effectiveness of pentachlorphenol solution in preventing decay of White Pine posts.

[1257]. 33.36.1 : 33.54. NEW ZEALAND. **Preservative treatment of fencing posts.**

N.Z. J. Agric. 72 (2), 1946 (193, 195–6). [New Zealand State Forest Service.] O.R.E.

To minimize the risk of fungous infection, barking and peeling of all round timber and thorough seasoning are advisable before soaking in creosote. A treating plant and the method (open-tank process) most suitable for farm use are described. A table is given showing the recommended duration of treatment (hot bath and cold bath) for the butt and top of various species including Pines, Eucalypts, Poplar, Willow, White Birch (*Betula alba*), Wattle, Mountain Beech (*Nothofagus cliffortioides*) Silver Beech (*N. menziesii*) and Larch (*Larix decidua*).

[1258]. 33.36.1 : 33.54. STARKER, T. J. **Preservative treatments of fence posts: 1944 progress report on the Post Farm.** *Bull. Ore. Engng. Exp. Sta.* No. 9–F, 1945. pp. 8.

[1259]. 33.36.1 : 33.8. LUMSDEN, G. Q. **Preservative treatment of wood cable reels for tropical use.** *Bell. Lab. Rec.* 24 (6), 1946 (217–8). D.S.I.R.

An account is given of the apparently successful treatment of wood cable reels for the Pacific War theatre with Wolman salts, Tanalith and pentachlorphenol in petroleum solvent. Creosote was found to be unsuitable since it cannot be painted or stencilled and is apt to bleed under hot sun after rain.

33.36.2. *Fireproofing*

[1260]. 33.36.2. GOTTSCHALK, F. W. **Some factors in the interpretation of small-scale tests for fire-retardant wood.** *Bull. Amer. Soc. Test. Mat.* No. 136, 1945 (40–1). P.R.

The most consistent and most easily established value for estimating the fire-retardant properties of wood is the final weight loss, but variations in test results are found to be considerable, partly due to normal characteristics of the apparatus used, and partly to lack of uniformity in the material tested. Under the latter heading come differences in moisture content, density, resin content and capacity for retaining fire-retardant chemical, all of which influence calculations of percentage loss in weight based on the initial weight of the specimen. These characteristics of wood must be recognized when preparing specifications.

[1261]. 33.36.2. **Fireproofing timber.** *Timber of Canada* 6 (11), 1946 (52, 55). *Repr.* from *Shipping World.*

The Department of Scientific and Industrial Research recently carried out three sets of tests on wood fireproofed by the 'Oxylene' process, which are believed to be the most severe tests yet made on fireproofed wood. As a result of these tests, which are described in detail, samples of treated Canadian Red Pine, 36 × 9 in. were classified as Class I material (surfaces of very low flame spread); doors of similar material were classified as Grade D (British Standard Definition No. 476, 1932); a bulkhead 10 ft. square and $1\frac{7}{8}$ in. thick, also of treated Red Pine, was also classified as providing Grade D resistance.

33.36.3. *Seasoning. Drying*

[1262]. 33.36.3. CARTER, R. M. **How to pile turning squares for rapid air-seasoning.** *Sth. Lumberm.* 172 (2161), 1946 (46–8). [Northeastern Forest Exp. Sta., Philadelphia, Pa.]

The purpose of this paper is to show how, by proper piling, the time required for air-seasoning wood squares and other stock for the turning industry can be shortened. Sketches illustrate two poor methods of piling and a method which will give good results in the shortest possible time.

[1263]. 33.36.3 : 12.25. JOYCE, C. **Reducing degrade in air-dried Hemlock flitches.** *Timberman* 47 (8), 1945–46 (96).

Details of a piling system worked out in Australian drying yards, which greatly reduced checking. About 25 per cent. of Canadian Hemlock was found to be quarter-cut. These flitches check on the edge and such checks do not matter, so stacks of quarter-cut timber were put round the perimeter of the stack to protect the more sensitive back-cut timber.

[1264]. 33.36.3 (68). SCOTT, M. H. **Timber seasoning in South Africa.** *Bull. Dep. Agric. For. S. Afr.* No. 254, 1945. pp. 40.

The paper deals briefly with the fundamental principles involved in the drying of timber with reference to structure, moisture content and shrinkage; the purpose of seasoning and the effect of the season, weather and dimensions; various methods of determining moisture content; the times taken to dry various South

African species to an air-dry condition under highveld conditions. Brief descriptions are given of the most common types of kiln at present in use, their construction, equipment and control. Under control, figures are given to indicate the amount of heat and rate of circulation required, and the object of steaming and high humidity treatment is stated.

Combined air and kiln seasoning is recommended for most general purposes, especially with hardwoods. The reconditioning treatment of collapsed wood, the drying rate of round poles, the usual defects met in air or kiln seasoning timber are noted. The paper concludes with notes on the seasoning properties of the more common South African exotic and indigenous timbers against each of which the appropriate standard kiln-seasoning schedule is indicated. Numerous figures and photographs illustrate points mentioned in the text. *From author's summary.*

[1265]. 33.36.3 : 07.7. SMITH, H. H. **Furnace-type lumber dry kiln: operation of an experimental unit.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1474–A, 1945. pp. 11 + tbl. + figs. (Supplement to Report No. *R*1474.)

A description is given of a kiln which differs from the conventional type in the methods of heating and maintaining relative humidity. Heat is provided by a sawdust burner, and temperature is controlled by rate of burning, i.e. by controlling the fuel and air supplies to the fire. A wide range of fuels may be used. The laboratory experiments indicated that green sawdust may be used at low cost, but when this is not available, coal, oil and gas are satisfactory. Relative humidity is maintained by automatic control of the vents and a water spray by a special wood-element hygrostat [illustrated]. The preparation and use of kiln samples and the cost of operation are discussed. Average burning rate of sawdust is estimated at approximately 40 lb. per hour, man-hours per day at approximately 1–1½ hours, and estimated daily operating costs at $2.70. Fire hazard is an important consideration and must be taken into account. [Cf. *For. Abstr.* 7 (No. 876).]

[1266]. 33.36.3 : 12.26–8 (79.5). VOORHIES, G. **The essentials of kiln drying Oregon hardwood lumber.** *Res. Leafl. Ore. For. Prod. Lab.* No. 2, 1944. pp. 17.

[1267]. 33.36.3. DÉRIBÉRÉ, M. Le séchage par rayonnement infrarouge dans l'industrie du bois. **[Drying by infra-red radiation in the timber industry.]** *Rev. int. Bois* 13 (106), 1946 (82–8, iv). [F.]

More detailed accounts of the author's researches in this subject, which have been reported previously in more general terms [cf. *For. Abstr.* 8 (No. 502)]. The theoretical basis of the process is dealt with in some detail, and applications to photography of wood and drying of wood, plywood veneers and sawdust are described. Results of experiments in drying Poplar, Oak, Beech and Alder are given.

[1268]. 33.36.3 : 33.15.1. WINLUND, E. S. **Utilization of electronics for the drying and laminating of wood.** *Rep. 4th Vermont Wood Prod. Conf.* 1944 (51–9). Vermont Bureau of Industrial Research, Norwich Univ., Vt. P.R.

The application of dielectric heating methods to wood bonding and to drying and seasoning is discussed. The problems of drying and seasoning by this method are complicated by many factors. Thin sections can be dried satisfactorily and certain species respond better than others, but with larger sections the problems of non-uniformity and provision for water egress remain unsolved.

[1269]. 33.36.3 : 33.31 : 33.34. WOODHOUSE, J. C., and BELL, C. D. (to E. I. du Pont de Nemours and Co.). **Treatment of wood.** *U.S. Patent* No. 2,395,311, Feb. 19, 1946. Chem. Abstr. 40 (9), 1946 (2610). P.R.

Description of a method for seasoning lumber with urea solutions to prevent checking and cracking, and at the same time bleaching the wood during drying operations. The urea solutions consist of 100 parts by weight of urea, 1 to 30 parts of bleaching agent, 0·25 to 20 parts of boric acid, and the remainder water. The bleaching agent is preferably sodium bisulphite. The solution is applied in the range of 5 to 800 lb. of urea per 1,000 bd. ft. of wood.

[1270]. 33.36.3 : 33.4. TIEMANN, H. D. **The importance of dry lumber for house construction.** *Sth. Lumberm.* 172 (2166), 1946 (48, 50).

Though much green lumber is at present being used in building construction, the writer urges the importance of using properly seasoned wood for permanent structures, and gives a brief account of the principles of kiln drying.

[1271]. 33.36.3 : 33.4 (73). TEESDALE, L. V. **Good wood houses are built of dry lumber.** *Rep. U.S. For. Prod. Lab., Madison* No. R1613, 1946. pp. 5. P.R.

A general discussion of the dangers which may arise from the use of inadequately seasoned timber in building construction, and the likelihood that this may occur on a wide scale in the United States owing to the great demand for housing materials.

33.37. Distillation. Manufacture of Tar

[1272]. 33.37 : 07.7. MALUEZIN, P. Le traitement des goudrons de bois et l'extraction de leurs huiles. **[The treatment of wood tars and the extraction of their oils.]** *France énergétique* Jan.–Feb., 1944 (31–3). [F.] *Abstr.* in *Rev. Eaux For.* 82 (6), 1944 (344–5).

Great progress was made during the war in the construction of light, semi-portable apparatus for the distillation of tar without the use of a vacuum or of superheated steam. One of the improvements in these boilers permits a considerable degree of dehydration of the tars, a necessary condition of vigorous fractionation of the oils. The oils thus obtained combine a high calorific power with other valuable qualities such as solvent power and richness in creosols, polyphenols and acid resins. This recent progress in distillation technique renders possible the production, in semi-mobile plants, of chemical by-products of distillation, whose value often exceeds that of the charcoal.

[1273]. 33.37 : 33.38. JORDI, F. Holz als Ersatzrohstoff im Gaswerksbetrieb. **[Wood as a substitute raw material in gasworks.]** *Schweiz. Z. Forstw.* 97 (4), 1946 (145–61). [G.g.f.]

Based on war-time experience at the Zürich Gasworks. Though the best available, wood can be only a partial and temporary substitute for coal in gas production, owing to the necessity of reducing it to blocks with a maximum side of 10 cm. (if existing plant is to be used without costly modifications), the lower quality of the gas, and the inferior yield of by-products. Comparative data are given on the calorific values of wood and coal and the thermal efficiency of the plant as affected by the raw material. From the point of view of calorific efficiency and on a water- and ash-free basis, 2·52 kg. of wood (Beech) are needed to replace 1 kg. of coal. The yields of gas and charcoal from 100 kg. of wood (25 per cent. moisture) are 42·8 Nm^3 (cu.m. at 0°C. and 760 mm. pressure) and 18 kg., as compared with 32 Nm^3 of gas and 72 kg. of coke from 100 kg. of coal. By special processes it is also possible to secure considerable cracking of the wood tar and decomposition of the acetic acid. Any wood may be used provided that its moisture content is suitably reduced, the moisture content of that used in the works described being 25 per cent.

Notes are included on plant (diagram) and processes, and tables are presented to show the raw materials used and the output of products, and the gross chemical composition (excluding water and ash constituents) of various woods, peat, and coals.

33.38. Charcoal Manufacture. Use of Wood and Charcoal in Producer-Gas Generators

See also *For. Abstr.* 8 (No. 1359).

[1274]. 33.38. GUILLAUME, P. La carbonisation des bois coloniaux. **[Charcoal from colonial woods.]** *Rev. int. Prod. colon.* 21 (199), 1946 (59–60). [F.] Also in *Rev. int. Bois* 13 (105), 1946 (64–5).

Experiments were made on the carbonization of creosoted sleepers of exotic timbers, removed from the track of French railways. The charcoal obtained was of high calorific value (7,500 calories) and very low ash content (2·5–3 per cent.), and gave excellent results in producer-gas engines. The method used (Guillaume system) permits of the carbonization of entire large timbers (e.g. railway sleepers). There is no recovery of by-products, but a considerable increase in the yield of charcoal and its carbon content are obtained by means of a different circulation of gas from that generally used. The carbon content of charcoal thus manufactured from exotic woods was 85 per cent. It is suggested that the manufacture of charcoal in the African colonies would provide a cheap and effective fuel for motor transport.

[1275]. 33.38 (44) : 32.7 : 94.4. Coopératives charbonnières. **[Cooperative organizations for charcoal production.]** *Chim. et Industr.* 52 (1–6), 1944 (151–3). [F.] D.S.I.R.

A plan is outlined for the formation in France of co-operatives for producing charcoal from wood waste, both for domestic purposes and for use in gas generators. The co-operatives would be situated according to the distribution of forest in the region concerned, should be fairly mobile and able to produce about 800 kg. of charcoal and 2,000 kg. of gas-generator fuel a day. Logging waste in French forests is estimated at about 7 million metric tons a year, of which 1·5 million should be available for carbonization and should produce a minimum of 250,000 metric tons of charcoal.

[1276]. 33.38.1. HELLER, O. **Charcoal.** *Brit. Patent* No. 563,460, Aug. 15, 1946. Chem. Abstr. 40 (9), 1946 (2610). P.R.

Charcoal is manufactured by continuous carbonization of wood in a chamber at a high temperature and in an oxygen-free atmosphere. The carbonization is started by hot oxygen-deficient combustion products, which are also used subsequently for making up losses by radiation. The heat of exothermic decomposition of the wood itself is utilized to effect the carbonization. The exothermal heat is carried off by the distilled vapours.

[1277]. 33.38.1. HELLER, O. **Charcoal.** *Brit. Patent* No. 563,461, Aug. 15, 1946. Chem. Abstr. 40 (9), 1946 (2610). P.R.

The wood, previous to carbonization, is dried and heated by a stream of inert gases, the temperature being maintained at nearly, but not more than, 270°.

[1278]. 33.38.2. RUDY, R. **Wood and charcoal as fuel for vehicles.** National Research Council of Canada, Ottawa. 3rd ed., 1944. pp. 65 + figs. *N.R.C.* No. 1187.

33.39. Manufacture of Sugar, Alcohol, and Miscellaneous Chemical Products

See also *For. Abstr.* 8 (Nos. 1166, 1220).

[1279]. 33.39. SCHOLLER, H. (vested in the Alien Property Custodian). **Purification of wood-sugar solutions.** *U.S. Patent* No. 2,394,334, Feb. 5, 1946. Chem. Abstr. 40 (8), 1946 (2305). P.R.

Sugar solutions obtained in the saccharification of wood by aqueous acids, after neutralization with $CaCO_3$, were evaporated *in vacuo* to a specific gravity of 1·34 and then heated at 90–100° with stirring for 8 hours, cooled, allowed to stand several hours and then diluted to a specific gravity of 1·28 by the addition of water. The resinous masses thus formed (which comprise 5–10 per cent. of the weight of total solids in the original solution) are removed by centrifuging. The sugar solution is then evaporated *in vacuo* to a specific gravity of 1·39 and may be used directly for the production of crystalline D-glucose or baking yeast, feedstuffs, etc.

[1280]. 33.39. HARRIS, E. E., and BEGLINGER, E. **The Madison wood-sugar process.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1617, 1946. pp. 14 + tbls. + figs. P.R.

A description is given of the pilot-plant process, developed by the Forest Products Laboratory, Madison, for converting wood waste, consisting of chipped slabs and edgings, sawdust and shavings, into ethyl alcohol by allowing dilute sulphuric acid, at temperatures from 150° to 180° C., to flow continuously through the charge of wood. Improvements on the Scholler process have been made by introducing: a new procedure for charging the digester; a method of automatically controlled continuous addition of the acid at the top of the digester; controlled removal of sugar solution from the bottom; controlled hydrolysis to avoid decomposition and lignin plugs; flashing the solution to a definite pressure so that methanol and furfural produced in the process may be recovered and excess steam may be used for heating of water; neutralizing automatically under pressure; filtering under pressure to remove calcium sulphate; flash cooling of the sugar solution and filtering again to remove organic precipitate which separates on cooling.

In comparison with the German Scholler process, hydrolysis was accomplished in less time because the sugars were removed more rapidly. Heating was at a lower rate, and heat given off by liquors on removal from the hydrolyser could be used more efficiently. Decomposition was less because the sugars were in contact with the acid for a shorter period of time, and consequently yields of sugar and alcohol were higher. Fewer by-products inhibiting fermentation were produced. Life of valves and other equipment was increased because they were not changed until the end of the run.

The sugar produced in 2·8 hours from a ton of dry, bark-free Douglas Fir wood waste

yielded 64·5 gallons of 95-per-cent. alcohol as compared with 3·2 hours for 58 gallons by the rapid-cycle method developed earlier, and 13–20 hours for 55 gallons by the Scholler process as practised in Germany.

The application of these methods to commercial plants and, in particular, to the hydrolysis plant at Springfield, Oregon, is discussed.

[1281]. 33.39 : 34.6 : 133.1 (73). DUNN, P. M. **Industrial alcohol from wood waste.** *Chem. Prod.* 9 (1/2), 1945 (15–7). L.S.

An account is given of the development of alcohol production from wood waste in the United States from 1942 onwards. The Scholler process, which consists of hydrolysing wood chips by successive batches of dilute sulphuric acid, removing the hydrolysate, neutralizing the excess acid and fermenting the resulting sugar solutions to ethyl alcohol, was modified as follows: (1) the pre-heating time was shortened, (2) the initial steam pressure was increased, (3) 'rest periods' were omitted, (4) the final steam pressure was decreased, (5) the treatment was stopped when the sugar solution dropped to 4° Brix, (6) the absorbed liquor was pressed from the lignin, (7) the acidic sugar solutions were neutralized hot, (8) the liquor was cooled by flash evaporation. The process is described. By changing the method of yeast fermentation in the plant, the sugar solution may be used to manufacture yeast suitable for a protein feed for livestock.

[1282]. 33.39 (43.1–5). GREAVES, C. **Bergius wood sugar plants at Mannheim-Rheinau and Regensburg.** *Final Rep. comb. Intell. Obj. Sub-comm.* No. 202, Item No. 22 [1945]. pp. 13. P.R.

A description is given of the Bergius wood-sugar plants at Mannheim-Rheinau and Regensburg, where glucose, alcohol and food yeast were produced. An important modification of the Bergius process was in use at Mannheim-Rheinau. The wood chips were first charged into a prehydrolyser with 1·5-per-cent. HCl solution and heated to a final temperature of 127° C. Sugars obtained by the prehydrolysis of Pine consist of 30 per cent. xylose and 70 per cent. hexoses, and are used for the production of food yeast. By prehydrolysis 40–45 per cent. yield of sugar can be obtained instead of 15 per cent. by the ordinary method. The residue is dried and hydrolysed with 41-per-cent. HCl in the usual way.

[1283]. 33.39 : 34.6 : 33.1. ABADIE, F. Contribution à l'hydrolyse des celluloses de bois. [**On factors in the hydrolysis of wood celluloses.**] *C.R. Acad. Sci., Paris* 220 (12), 1945 (409–10). [F.] D.S.I.R.

Sawdust of Poplar wood (100 kg.) was macerated with 136 kg. of sulphuric acid at 60° B. 250 litres of water was added and the mixture was heated between 80° and 100°, neutralized and filtered, and the glucose extracted. Time of maceration (T) was varied from 15 to 300 minutes, and time of heating (t) from 0 to 30 minutes. Whatever the value of t, the yield of glucose rose at first with T and then diminished. It is therefore only during maceration that the cellulose is reduced to hydrolysable products; subsequent heating only hydrolyses the products of maceration, hence the cellulose must be broken down as far as possible before the point where the products themselves are attacked, i.e. the optimum value of T must be determined. Whatever the time of maceration, total hydrolysis of the products was always reached after a certain time of heating. The empirical formula for showing the influence of t is given as follows:—

$$G(t) = G(0) + [G(30) - G(0)] \log_{10}(1 + 0{\cdot}30t)$$

where G = percentage of glucose obtained.

[1284]. 33.39 : 31.3 : 12.25. WISE, L. E., and MOORE, S. T. **The ether-soluble extractive of Black Sprucewood.** *J. organ. Chem.* 10 (6), 1945 (516–9). L.S.

A Black Sprucewood contained about 0·8 per cent. ether-soluble extractives. These were fractionated quantitatively into resin acids, saturated and unsaturated fatty acids, and unsaponifiables. The latter contained significant amounts of a phytosterol, $C_{29}H_{50}O$, which may be identical with the widely distributed 22,23-dihydrostigmasterol. *Authors' summary.*

[1285]. 33.39 : 31.3 : 12.25 : 34.26. ANDERSON, A. B. **Chemistry of Western Pines. Distribution and nature of acetone soluble extractives in Ponderosa Pine.** *Industr. Engng. Chem.* (*Industr. Ed.*) 38 (4), 1946 (450–4). P.R.

Wood from three mature trees from three widely distributed stands of Ponderosa Pine was reduced to sawdust and extracted in Soxhlet extractors with chemically pure acetone. The acetone retained in the wood can be removed by heating in the presence of water.

The acetone-soluble extractives were separated into their major chemical entities and the results of the analyses are shown. The greatest quantity of extractives occurs at the butt heartwood and the least at the outer sapwood. In the case of heartwood extractives the products found in approximate order of quantity present are: resin acids, free fatty acids, unsaponifiables, esters, volatiles, water-solubles, and water- and ether-insolubles. In sapwood extractives these entities are found in the following order: free fatty acids, resin acids, water-solubles, esters, unsaponifiables, water- and ether-insolubles, volatiles. The removal of the extractives results in an improved timber and since they appear to exist in sufficient quantities, their removal and recovery is worthy of consideration as a commercial proposition.

33.4. *Converted Structural Timber*

[1286]. 33.4 : 38.2. ENGLE DE JANOSI, K. L. **Evolution of wooden flooring.** *Wood* 11 (8), 1946 (219–22).

33.5. *Pitprops. Sleepers. Poles and Other Roughly Converted Wood*

[1287]. 33.5 (931) : 31.4. SCHOEN, R. H., and HARRISON-SMITH, J. L. **Timber for coal mines in the Waikato district.** *N.Z. J. For.* 5 (2), 1945 (137–44).

The uses of timber in a coal mine, and the conditions prevailing, are discussed with particular reference to the Waikato field. The small amount of data available on the life of timbers in different situations is noted, and the suggestions made that there is a wide field for research in the preservative treatment of mining timber. *Authors' summary.*

[1288]. 33.51 : 31.27. CRESTIN, F. Essais mécaniques sur bois de mines. **[Mechanical tests on mining timber.]** *Rev. Eaux For.* 84 (4), 1946 (201–11). [F.]

Bending and compression tests were made on 3 series of specimens of mining timber: (1) poles which had been stored under cover, (2) poles which had been stored off the ground but fully exposed to the weather for 6 months, (3) poles stored as in (2) for 12 months. The testing methods are described in some detail [cf. *For. Abstr.* 7 (No. 1949)]. It was found that the various conditions of storage had little apparent effect on the mechanical properties of the wood, and static resistance was often greater in the third than in the first series.

[1289]. 33.53 : 07.7. **Pole-peeling machine.** *Timberman* 47 (7), 1946 (108–10).

Description of a new pole-peeling machine, designed and manufactured by Cecil Straiton of Tacoma, Washington. It is claimed that the machine (which can be used all the year round, whereas hand peeling can only be done from April or May to July or August) will save 75 per cent. of pole-peeling costs and with 4 men will do the work of 20 men, peeling the same number of poles in less time, with a superior product. Poles from 3 in. to 3 ft. in diameter can be peeled. The machine, which is driven by 4 electrical engines, costs from $12,000 to $20,000 retail.

33.6. *Packing Boxes, Crates, etc.*

[1290]. 33.6. LARSEN, A. **Bouncing boxes.** *Sth. Lumberm.* 172 (2160), 1946 (55–6).

A description of a wooden box designed and used by the U.S. Air Force for dropping supplies. The sides are of $\frac{3}{4}$- or $\frac{5}{8}$-in. boards nailed together, with triangular corner braces and reinforced, after packing, by 35 ft. of high-tensile round steel strapping. In tests and in service the boxes did not break open or explode, though they sometimes rebounded from the ground as much as 30 ft. and rolled over repeatedly before coming to rest.

[1291]. 33.6 : 33.15.2. **New flexible veneer box developed.** *Timberman* 47 (8), 1945–46 (84).

The Elmendorf Corporation of Chicago have evolved a new material for box-making, consisting of a sheet of flexible veneer faced on one side with heavy kraft paper. Sides and ends of the box are made of one piece of veneer, mitred at the corners; top and bottom pieces are attached with a dry-bonding waterproof adhesive which sets upon contact. Great strength is claimed for the box. Tests show that an empty container made of this material can support the combined weight of two men.

[1292]. 33.6 : 31.22.1. LASSEN, L. **Influence of temperature on relative humidity within confined spaces with and without a desiccant.** *Mimeo. U.S. For.*

Prod. Lab., Madison No. *R*1498, 1945. pp. 30 + plates + tbls. P.R.

In an analysis of all data available on influence of temperature changes on the relative humidity within a package that contains both a desiccant and dunnage, special attention was given to those properties of silica gel and wood that are instrumental in the determination of the relative humidity of a package. For the purposes of this report the meaning of the word dunnage is restricted to wood, fibreboard, and regenerated wood fibre. Dunnage with a moisture content of 4 per cent. or less may be used as a desiccant within impermeable barriers. Dunnage cannot, however, be recommended as a desiccant within permeable barriers, because of difficulties involved in replacing it.

33.7. *Firewood*

[1293]. 33.7 (44) : 07.7. RANDET, P. Le bois de feu dans l'économie générale. [**Firewood in the general economy.**] *Rev. Eaux For.* 82 (8), 1944 (433–57). [F.]

The writer discusses the past history, present situation and probable future of the use of firewood in France, gives estimates of possible production, and some account of recent improvements in wood-burning stoves. Research is needed for the purpose of designing improved models of wood-burning water heaters and bakers' ovens.

33.8. *Other Manufactured Products*

[1294]. 33.8. SHENSTONE, B. S. **The DFS Reiher sailplane.** *Aircraft Engng.* 18 (206), 1946 (110–6). P.R.

The development of the DFS Reiher sailplane and its construction is described. A comparison is made of the values of Ash, resin-impregnated Beech, Spruce, dural and steel for the wing construction.

[1295]. 33.8 : 31.22.1. DROW, J. T., and CLARK, M. E. **Moisture content of wood in airplane structures.** *Rep. U.S. For. Prod. Lab., Madison* No. 1552, 1945. pp. 10 + tbls. + figs. P.R.

The date summarized in this report indicate that the present value of 15 per cent. moisture content used in wood aircraft design is not high enough to include all conditions of service. This is apparent from the results of tests on actual aircraft parts in which values exceeding 15 per cent. were measured.

Studies on matched specimens at various locations show that on uncoated material maximum values considerably in excess of 15 per cent. were found in many parts of the United States, and that the 15 per cent. level was exceeded even in the case of varnished material. On the other hand the conditions of exposure for these specimens were quite different from those encountered in aircraft structures.

The aircraft wing study showed that, during the period of one year covered by the observations, moisture content values in excess of 15 per cent. occurred in one or more uncoated specimens on more than one half of the dates on which measurements were made. The use of finishing materials of aircraft parts might tend to reduce the probability of high moisture content to some extent as compared to the unfinished wood, but it is questionable whether the two coats of aircraft sealer now commonly specified can be relied upon to exert any substantial effect. Flight conditions, or differences in exposure on the ground, might likewise be expected to influence the moisture content, but it would not seem justified to rely upon any considerable reduction when dispersal of planes on the ground in stationary positions is a distinct possibility.

The determination of a proper design moisture content would appear to depend largely upon a decision as to whether such a design value is to be fixed at a level high enough to include: (1) all, (2) a substantial percentage, or (3) some lesser percentage of moisture content values that might be encountered under severe conditions.

(1) To include all specimens under severe conditions would require a design value of at least 24 per cent.

(2) To include a substantial percentage of moisture content values that might be encountered, and to ensure that the design value would be exceeded only a small proportion of the time under severe conditions, would require an increase in the design level to some 17 or 18 per cent.

(3) In the recorded data, the present 15 per cent. design value is exceeded somewhat more

than half the time, but, for the United States and Canada as a whole, the percentage of time in which the 15 per cent. level is exceeded might be quite different if data were available on the proportion of use under varying conditions. *Authors' summary.*

[1296]. 33.8 : 33.15.2. **Sensitized plywood speeds construction of Boeing bombers.** *Comm. Photogr.* 20 (11), 1945 (352, 354, 356).

An account of the use of sensitized plywoods in the construction of Boeing Bombers. For the manufacture of plywood templates or for plywood display photographs, etc., the plywood surface is sprayed with liquid photo-emulsion and the required image is projected on it at the exact scale required.

[1297]. 33.8 : 33.15.2. **Development of a light weight flooring.** *Struct. & Mat. Note Div. Aeron. Coun. sci. industr. Res. Aust.* No. 63, 1943. pp. 7 + tbl. + fig. A.H.

Three forms of lightweight flooring for transport aircraft were tested under distributed and concentrated loads. The floors were a 'sandwich' construction consisting of two sheets of thin three-ply wood, separated by a grid of wooden slats. This type of construction was further developed to deal with the special conditions associated with the transport of boxes of ammunition. The types of construction are described and test results given.

[1298]. 33.8 : 33.15.3. GEEN, H. A., and STEENWYK, H. VAN. **Compregnated wood antenna masts for aircraft.** *Resin. Reptr.* 6 (5), 1945 (12–4). D.S.I.R.

An account of the methods of manufacture of a compreg-and-brass antenna radio mast for use in aircraft. The mast is water- and weather-resistant and possesses the mechanical strength to withstand severe vibration.

[1299]. 33.8 : 33.15.3. DYER, A. E. R. **Wood plastics for air screws.** *Mon. Engng. Art. Sci. Dep. Brit. Coun.* 2 (12), 1945 ([15–6]). D.S.I.R.

Veneers are treated with 'Formvar', a thermoplastic resin of extreme toughness and durability, and consolidated under heat and two-way compression. The product, 'Hydulignum', which is manufactured by the Hordern Richmond Aircraft Company, has the following mechanical characteristics:—

Density: 82 lb. per sq. ft.
Specific gravity: 1·31.
Shear: Longitudinal tangentially: 4,450;
longitudinal normal: 4,480.
Modulus of elasticity: 4 lb. per sq. in. $\times 10^6$.
Tensile strength: nearly 20 tons.

It has been used with marked success for air screws and, owing to the perfect balance of shear obtained, allows the airscrew blades to be constructed with much smaller root diameters than those customarily used.

[1300]. 33.8 : 33.15.2. **Improved load-carrying structural members for aircraft, boats and the like.** *Aust. Patent* No. 119,585 [*n.d.*]. A.H.

The structural member, which has been used successfully for aircraft flooring and in experimental wing construction, consists of two skins of thin sheets of plywood, metal, reinforced synthetic resin or other suitable material, stabilized and connected together by a core consisting of strips of wood, metal or other shear-resisting material, arranged on edge in the form of a grid or cellular structure. The proportions are so arranged that the skins carry nearly all the tensile, compressive and shear forces when the structure is under load, the grid core serving only to stabilize the skins against buckling and to prevent their independent action.

[1301]. 33.8 : 33.15. FONTAINE, W. H. DE. **Waterproof glue comes into its own.** *Yachting* 79 (1), 1946 (93–4, 212, 216). L.S.

A general review of the development of glued, laminated plywood boats, with an account of the types of waterproof glue used in such constructions.

[1302]. 33.8 : 33.15. **Lightweight boat of molded plywood developed.** *Resin. Reptr.* 7 (2), 1946 (2–5). P.R.

The making of a moulded plywood boat with a seamless hull by the use of the bag-moulding process with synthetic-resin adhesives is described.

[1303]. 33.8 : 33.15 (94). SWINFIELD, A. N. **The developments and application of marine plywood in boat and shipbuilding.** *Aust. Timb. J.* 12 (1), 1946 (26, 55).

For some time before the war, plywood of marine quality was being manufactured in Australia. Its increasing use during the war

led to the formulation of a standard specification (Australian Standard Specification No. (E) F501–1944). It is suggested that every sheet of plywood constructed to this specification should be marked in such a manner as to leave no doubt of its quality and use.

[1304]. 33.8. LAMBERT. Emploi du bois dans la construction du matériel roulant des chemins de fer. **[The use of wood in the construction of railway rolling stock.]** *Rev. Eaux For.* 79 (4), 1941 (242–62). [F.]

[1305]. 33.8. DAGUET, G. Le bois dans la carrosserie automobile. **[Wood in motor-car body-making.]** *Rev. Eaux For.* 79 (12), 1941 [899–909]. [F.]

[1306]. 33.8. LACARRIÈRE. La fabrication des manches d'outils et objets tournés. **[The manufacture of tool handles and turned articles.]** *Rev. Eaux For.* 79 (12), 1941 (910–21). [F.]

[1307]. 33.8. ANTHONY, J. **Snath shaping.** *Timber of Canada* 6 (8), 1945–46 (39–41).

An account of a factory at Waterville, Quebec, which manufactures scythe handles, at a rate of about 120,000 a year, for use in Canada and all parts of the British Empire. The traditional wood for the purpose is White Ash [*Fraxinus americana*] because it is relatively easy to bend and each handle has 6 bends, in two planes. Shortage of Ash led to the use of Elm and Cherry, which often break during bending, and they are now treated with urea to make them easier to bend.

[1308]. 33.8 : 12.26–8 : 31.1. CORMIO, R. Monografia sui ciocchi di *Erica arborea* di Eritrea e di Calabria. Ricerche sperimentali e applicative per accrescere la resistenza del ciocco di *Erica arborea* di Eritrea alla combustione del tabacco. **[Monograph on roots of *Erica arborea* from Eritrea and Calabria. Experimental and practical researches to increase the resistance of Eritrean *Erica arborea* to tobacco burning.]** *Repr.* from *Ingegnere, Roma* Aug.–Sept., 1943. pp. 26. [It.] X.

A comparative analysis of the anatomy of roots of *Erica arborea* from Calabria and Eritrea for the purpose of discovering the cause of the inferiority of pipes made of the African plants. It is concluded that this is due to the greater number and size of the medullary rays in the latter and to the different boiling temperature to which they are subjected for 12 hours (73° C. in Eritrea and 92° in Calabria). If the Eritrean roots are boiled in an autoclave at 92 degrees, in a fireproofing solution, the results are equal to those from Calabrian roots.

[1309]. 33.8 : 33.15.3. BULLARD, W. I. **The Plyweld picker stick: an adaptation of Pregwood.** *Sth. Lumberm.* 172 (2160), 1946 (58).

Hickory is being replaced in American textile mills by Plyweld, for the manufacture of picker sticks. Plyweld is a laminated plastic of 14 plies of Sugar Maple, impregnated with resin and bonded under heat and pressure to a definite degree of density, which permits a predetermined degree of flexibility.

[1310]. 33.8 : 33.15.3 (94). **Australian timber found suitable for textile rollers.** *Text. J. Aust.* 20 (7), 1945 (300). L.S.

Tests on some Australian species suggested that high-density Silver Ash, Saffronheart and Greybox are suitable for making spinning and drawing-frame rollers. High-density compregnated wood is also recommended.

[1311]. 33.8 : 33.1. CADY, E. L. **Wood as an engineering material.** *Metals and Alloys* 21 (4), 1945 (980–5). L.S.

A general review of modern uses of wood, improved woods and plywood, with special reference to their use in engineering, e.g. for dies, jigs, moulds, machinery parts, etc. A table gives characteristics and some specific engineering properties of some processed woods.

[1312]. 33.8 : 33.15.3. ARMSTRONG, C. S. **Properties and application of stabilized wood.** Curtiss-Wright Corp. Airplane Division Research Laboratory, Buffalo, N.Y. No. WG–12–M–3, 1945. pp. 27 + plates. P.R.

It is the purpose of this report to give the properties and methods used in handling compreg and to point out some of the uses and applications to which it has been put, particularly for the manufacture of forming tools, drill jigs, dies, etc. Some of the advantages of using compreg for such tools are: good dimensional stability; high strength values; excellent dielectric properties; ease of working; low cost as compared with metal on a volume basis; does not delaminate as compared with some organic materials used for tooling; does not check, crack or break, as compared with cast plastics;

maintains sharp corners and edges as compared with fabric-plastics laminates; low coefficient of friction, does not scratch aluminium; increased tool life as compared with certain metals and other materials. Some comparative costs of compreg tools and tools made from other materials are given.

33.9. *Grading and Storage of Converted Timber*

[1313]. 33.91 : 12.25 (73). **Standard grading rules for Ponderosa Pine (*Pinus ponderosa*), Sugar Pine (*Pinus lambertiana*), Idaho White Pine (*Pinus monticola*), Lodgepole Pine, Larch, Douglas Fir, White Fir, Engelmann Spruce, Incense Cedar, Red Cedar Lumber, effective July 1, 1942.** Western Pine Association, Portland, Oregon. 1942. pp. ii + 114. With supplement, 1944. pp. 4.

[1314]. 33.92 : 31.22.2. DUNLAP, M. E. **Methods of controlling humidity in woodworking plants.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1612, 1946. pp. 4 + tbl. P.R.

The report deals with the problem of maintaining conditions in shop and storage rooms in the U.S. which will prevent swelling and shrinkage of wood with seasonal changes in relative humidity. Such conditions need regulating most often in buildings which are heated in winter, although in damp climates, such as the Gulf Coast, dehumidification of the atmosphere may also be necessary. It is desirable to maintain a relative humidity of about 45 per cent. during winter. Methods of humidity control are briefly described, and a list of manufacturers of apparatus for controlling humidity in factories is appended.

34. MINOR FOREST PRODUCTS AND THEIR UTILIZATION

34.1. *Products of the Soil*

[1315]. 34.1 (494). KUSTER, A. Die Torfproduktion während des zweiten Weltkrieges. **[Peat production [in Switzerland] during the second world war.]** *Schweiz. Z. Forstw.* 97 (6), 1946 (257–8). [G.]

34.2. *Vegetable Products*

[1316]. 34.2 : 12.26–8 (66.2). CHEVALIER, A. Sur la culture au Soudan français du karité ou Arbre à beurre (*Butyrospermum parkii*) et de l'Arbre à kapok ou Boumon (*Bombax angulicarpa*). **[On the cultivation of the Shea Butter tree (*Butyrospermum parkii*) and the Kapok or Boumon tree (*Bombax angulicarpa*) in the French Sudan.]** *C. R. Acad. Sci., Paris* 200 (13), 1945 (415–6). [F.] D.S.I.R.

The present state of some *Butyrospermum parkii* and *Bombax angulicarpa*, planted experimentally about 40 years ago at the School of Agriculture, Katibougou, suggests that the selection and cultivation of suitable races of these trees would be of great value to the French Sudan, both because of their products, and also because of the desirability of encouraging arboriculture among the natives in order to prevent erosion.

34.21. Fodder Grass and Grazing

[1317]. 34.21 (54.5). MAHENDRU, I. D. **Management and improvement of grazing in waste lands of the Punjab.** *Indian For.* 72 (4), 1946 (168–71). (6th Silvicultural Conference, Dehra Dun, 1945).

Results of a small-scale grassland survey carried out in 1944 in the low hills of the Kangra district near Nurpur. Shading by trees and shrubs was observed to be inimical to the growth of *Themeda anathera* and *Chrysopogon montanus*. This fact is of special significance in relation to the management of grazing, as it indicates that unduly long closure may result in the deterioration instead of the improvement of useful grasses.

[1318]. 34.21 (54.7). KUMAR, L. S. S. **Better utilization of forest grasslands in Bombay Province.** *Indian For.* 72 (4), 1946 (162–4). (6th Silvicultural Conference, Dehra Dun, 1945).

Moderate grazing is in no way inimical to forest grasslands, although over-grazing can cause considerable damage. In areas where grazing is permitted, it should be of the rotational or intermittent types. The best method of rotational grazing involves dividing the grazing area into several compartments which are grazed one at a time. By commencing grazing with different compartments in different successive seasons, rotation in time

is achieved as well as rotation in space. The advantages of such a system are summarized. Data are given on the average number of acres of grassland required per animal in different rainfall areas.

[1319]. 34.21 (728.4). WATKINS, J. M. **The forage resources of Latin America—El Salvador.** *Bull. imp. Bur. Past. Forage Crops* No. 35, 1946. pp. 24 + plates. [E.span. port.]

Morron (*Crescentia alata*), a tree growing on poorly drained soils at elevations of 100–600 m., provides almost the only source of food for stock during the dry season in certain areas. The fruits which drop to the ground are eaten by stock either green or in a fermenting condition.

[1320]. 34.21 (73) : 97.3. **The history of western range research.** *Repr.* from *Agric. Hist.* 18, 1944 (127–43).

[1321]. 34.21 (76.3) : 97.3. CAMPBELL, R. S. **Determination of grazing values of native vegetation on Southern Pine forest ranges.** *Ecology* 27 (3), 1946 (195–204). [Southern Forest Exp. Sta.]

Studies in Louisiana in 1944 and 1945 showed about 1,389 lb. green herbage per acre (air dry) on open grassland, 745 lb. in an Oak type and 626 lb. in an old-growth Pine type, on unburned range in July. Production was about double this amount by October, but was less palatable and nutritious. Production on burned range in July was about one-third less, but was considerably more available and edible. Thus range forage in southern Longleaf Pine forests is sufficiently abundant and valuable, even under rather well stocked old-growth Pine stands, to justify utilization for cattle grazing when sufficient acreage is available. Nutritive values of the native forage were far below maintenance for cattle in winter, but were entirely adequate for good gains during March and April, with 11–13 per cent. protein on a moisture-free basis and a satisfactory mineral content.

Development of a practical management system on Southern Pine forest ranges means making the most of the relatively high forage values in spring and early summer. Forestry measures which encourage more or better forage are desirable. These include such intensive forestry practices as pulpwood thinnings and other partial cuttings, especially in short rotations, to open up crowded stands and provide rapid tree growth. The conservative use of fire as a silvicultural tool or to reduce fire hazard appears to improve forage values. The combined production and income from livestock and timber should be greater than from either alone. [Cf. *For. Abstr.* 7 (No. 352)]. *From author's summary.*

[1322]. 34.21 (79.4) : 97.3. TALBOT, M. W., and HORMAY, A. L. **First-season records of cattle weights from a Pine-timber range and a mountain meadow range.** *For. Res. Note Calif. For. & Range Exp. Sta.* No. 44, 1945. pp. 8.

Data are presented on the comparative value of forest and meadow pasture in California. Two groups of 10 yearling Hereford heifers were pastured from June to October in a 555-acre cut-over Pine pasture and a 128-acre mountain pasture respectively. The cattle grazing in the timber type gained about the same weight as those in the meadow and maintained weight longer in the autumn. The meadow herd, however, started to gain weight about 5 or 6 days earlier and reached maximum weight 17 days earlier than the timber herd. Most of the weight gains in both types were made from the time the flower stalks began to show on the principal forage species until the forage was about 80 per cent. dry. The results show that efficient use of this kind of mountain range depends upon close control over the movements and distribution of cattle, and emphasize the advantages of more timely grazing of each range type when its forage is most nutritious.

34.24. Tanning Materials

See also *For. Abstr.* 8 (No. 1359).

[1323]. 34.24 : 12.14.8 : 12.11.11. SEGALL, G. H., and PURVES, C. B. **Chemical composition of wood barks.** *Pulp Paper Mag. Can.* 47 (3), 1946 (149–61). [Pulp and Paper Research Institute of Canada].

After outlining the complex botanical structure of bark, the work of Zellner and others on the separation of chemicals extractable by neutral solvents is reviewed. These substances include crystalline fats, waxes, higher fatty acids, and alcohols, hydrocarbons, sterols,

terpene derivatives, and many similar compounds of undetermined structure. Uncrystallized fractions include fats, waxes, resin acids, phlobaphenes, tannins, and polysaccharides. The solvent-extracted residue consists of polysaccharides, of substances responding as Klason lignin, and, usually in smaller amount, of suberin. Ash and nitrogen contents of bark are usually about 10 times as great as those of wood. Although oxidative methods produce 'lignin'-free pulps in up to 40-per-cent. yields from bark fibre fractions, such pulps do not seem to be constitutionally identical with those from woods. There is need of new chemical techniques for studying barks. Possible methods of recovering extractives from commercial barks are briefly reviewed, but the residues are not likely to become an economic source of high-grade pulps. *From authors' summary.*

[1324]. 34.24 (67.5). STANER, P. Matières tannantes du Congo Belge. **[Tanstuffs of the Belgian Congo.]** *Bull. agric. Congo belge* 36 (1/4), 1945 (135–43). [F.Flem.]

Black Wattle (*Acacia decurrens* var. *mollissima*) has been cultivated for many years in the east of the colony and is perfectly acclimatized. The bark yields 11·5–18 per cent. tannin compared with up to 35 per cent. from the same species in Natal. There are some 20,000 ha. of Mangrove swamp, containing *Rhizophora mangle* and *R. racemosa*. The bark from these yields 10–20 per cent. tannin. A tree of average size has bark 2–2·5 cm. thick at the base of the trunk and 1–1·5 cm. on the larger branches. The yield of dry bark is estimated at 180 kg. per ton of Mangrove felled, which will produce 45 kg. of dry extract containing 50 per cent. tanstuffs. The results of analyses are given for a number of other species. The most promising of these is *Terminalia catappa*, the extract from which contains 60 per cent. soluble tannins.

[1325]. 34.24 : 12.25. BOURQUIN, A. Comment préparer l'écorce d'épicéa pour la tannerie? **[How should Spruce bark be prepared for the tannery?]** Association suisse d'économie forestière, Soleure. 3rd ed., [*n.d.*]. pp. 16 [F.] P.R.

[1326]. 34.24 : 12.25. KUBELKA, V., and MASNER, L. **Sulphiting of Spruce bark in extract manufacture.** *Collegium, Haltingen* 1943 (33–59). Brit. Abstr. BII, 1946 (65). P.R.

Extraction of Spruce bark with Na_2SO_3 and alkali gives 12·5 per cent. more extract than with H_2O alone. The resulting extract is redder in colour and gives more sludge on keeping. It penetrates the hide more quickly, but is absorbed less readily than the normal extract. [Cf. *For. Abstr.* 7 (No. 1959).]

[1327]. 34.24 : 12.26–8 : 21.0. HERMANN, F. J. **Economic plants of interest to the Americas: Wattle bark.** Office of Foreign Agricultural Relations, U.S. Department of Agriculture. [1943?] pp. 10.

Notes on *Acacia* spp. used for tannin production and suggestions for their possible cultivation in America. Wattle has been grown successfully in California and other possible areas are Arizona, New Mexico, Florida and Eastern Texas. California-grown Wattle barks compared favourably with similar barks grown in Australia, Black Wattle (*A. decurrens* var. *mollissima*) showing 48·6 per cent. tannin, and Golden Wattle (*A. pycnantha*) 46·8 per cent. California-grown Black Wattle is richer in tannin than that grown in Australia.

34.25. Medicinal Plants

[1328]. 34.25 : 12.26–8 : 21.0. BLAKE, S. F. **Economic plants of interest to the Americas: Cassia and Cinnamon.** Office of Foreign Agricultural Relations, U.S. Department of Agriculture. [1943?] pp. 7.

Production of commercial cassia (*Cinnamomum cassia*) and cinnamon (*C. zeylanicum*) has been confined to south-eastern Asia and neighbouring islands. Cinnamon has been grown in French Guiana and Brazil, but the S. American product has so far been inferior to the Asiatic. Notes are given on plantation technique.

[1329]. 34.25 : 12.26–8 : 12.11.11. RAYMOND-HAMET, M. Yohimbol et cinchonamine. **[Yohimbol and cinchonamine.]** *C.R. Acad. Sci., Paris* 220 (18), 1945 (670–1). [F.] D.S.I.R.

A discussion of the possible structure of the molecules of the related alkaloids, yohimbol and cinchonamine, the gross formulae of which are sufficiently distinct to suggest important differences in their chemical constitution.

Structural formulae are suggested for yohimbine and yohimbol.

[1330]. 34.25 : 12.26–8 : 12.11.11 : 12.14.8. JANOT, M.-M., and GOUTAREL, R. La corynanthidine, quatrième alcaloïde cristalisé isolé des écorces de *Pseudocinchona africana* Aug. Chev. **[Corynanthidine, fourth crystalline alkaloid isolated from the bark of *Pseudocinchona africana*.]** *C.R. Acad. Sci., Paris* 220 (17), 1945 (617–8). [F.] D.S.I.R.

An analysis and description of the properties of corynanthidine. It is an isomer of corynanthine and yohimbine and has some of the characteristics of Lillig's α-yohimbine.

[1331]. 34.25 : 12.26–8 : 12.11.11. RAYMOND-HAMET, [M.]. Sur un alcaloïde des quinquinas n'appartenant pas au type quinolyl-quinuclidique. **[An alkaloid of the Cinchonas which is not of the quinolyl-quinuclidine type.]** *C.R. Acad. Sci., Paris* 221 (11), 1945 (307–8). [F.] D.S.I.R.

A discussion of the properties of aricine, an alkaloid of the Cinchonas belonging, like cinchonamine, to the indole type.

[1332]. 34.25 : 12.26–8 (86). FOSBERG, F. R. **The work of the botanists of the *Cinchona* mission in Colombia.** *Chron. bot. Cal. MCMXLV* 9 (2/3), 1945 (119–20). O.B.D.

Results seem to support Standley's conservative view that Colombia has only four species in the genus *Cinchona* proper, *C. henleana* being more closely related to *Ladenbergia*. There appear to be many well defined geographical varieties of *C. officinalis* and *C. pubescens* which differ markedly in gross morphology, bark morphology and analytical characteristics. In Colombia, the genus *Cinchona* is found in temperate mountain rain forests at an elevation of 1,500 to 3,000 m.

[1333]. 34.25 : 12.26–8 (86). STEERE, W. C. **The work of the botanists of the *Cinchona* mission in Ecuador.** *Chron. bot. Cal. MCMXLV* 9 (2/3), 1945 (121–3). O.B.D.

The discovery of *C. pitayensis* in Ecuador has added a valuable new bark source; other species found there for the first time included *C. lucumaefolia*, *C. microphylla*, and *C. nitida* (all from the Loja zone); their economic value has still to be determined.

34.26. Resin. Gums. Turpentine. Oils. Rubber. Latex.

See also *For. Abstr.* 8 (No. 1316).

[1334]. 34.26. CEYLON. **Silvicultural research: Ceylon: 1944.** Office of the Conservator of Forests, Colombo, Ceylon. 1946. pp. 16.

A number of trees of Rock Cypress [*Callitris* spp.] were tapped experimentally for their resin for use in manufacturing French polish. There is apparently a wide variation in the resiniferous character of individual stems. The healthy stems are poor yielders and the unhealthy, moribund stems are best. It would appear that natural resin exudation in this species is a pathological rather than a traumatic condition (p. 14).

[1335]. 34.26 : 12.25. SNOW, A. G. **The use of chemical stimulants to increase gum yields in Slash and Longleaf Pines.** *Occ. Pap. Sth. For. Exp. Sta.* No. 106, 1944. pp. 36. [Southern Forest Experiment Station.]

This paper is devoted primarily to experimental work carried out in 1942 and 1943 [cf. *For. Abstr.* 6 (p. 251)]. No attempt is made to summarize all the work previously published, but pertinent papers are cited. Consistently greater yield increases have been obtained with sulphuric and hydrochloric acids than with any other single chemical. Still further increases were obtained from treatments with chemical combinations of sulphuric acid with sodium arsenite, potassium phosphate, or potassium aluminium sulphate. The most effective concentration of sulphuric acid for treating Slash Pine [*Pinus caribaea*] was found to be 40 per cent., and for Longleaf Pine [*P. palustris*] 60 per cent. Adequate chemical application was found to be almost as important as concentration, yield increases up to 121 per cent. being obtained with careful treatment. Greatest yields were obtained from weekly chipping with acid treatment. It was found that taking off the bark, down to but not including the wood, and treating with acid, gave greater yields than applying acid to a streak cut in the wood. Weekly yield records of treated and untreated trees indicated that, after about 20 streaks, the increased yield from chemical treatment usually declined. Continued chipping without chemical treatment for the rest

of the year is economically sound, and leaves the trees in better condition to respond to chemical treatment in the following season. No apparent permanent injury to the tree results from the use of chemical stimulants to increase gum yields, nor does the quality of resin or yield of turpentine show signs of deterioration. *From author's summary.*

[1336]. 34.26 : 12.25. RUNCKEL, W. J., and KNAPP, I. E. **Viscosity of Pine gum.** *Industr. Engng. Chem.* (*Industr. Ed.*) 38 (5), 1946 (555–6). P.R.

Samples of three varieties of Pine gum—Slash gum, Longleaf gum and Longleaf scrape—were diluted with freshly distilled gum turpentine (density 0·8605 at 26·8° C.) to concentrations of 25, 30, 35 and 40 per cent. turpentine by weight. Viscosities were then determined in a Stormer viscometer.

[1337]. 34.26 : 12.25. MIROV, N. T. **Composition of gum turpentine of Coulter Pine.** *Industr. Engng. Chem.* (*Industr. Ed.*) 38 (4), 1946 (405–8). P.R.

Analysis showed that the turpentine of a rare Coulter Pine growing in California consists of two terpenes: l-α-pinene and l-β-phellandrene with an admixture of two paraffin hydrocarbons, n-heptane and n-undecane. The presence of paraffins in Coulter Pine turpentine shows once more that turpentine as obtained from Pine oleoresins is not always a mixture of terpenes alone. Probably an admixture of paraffin hydrocarbons to the terpenes is more common than earlier investigations had indicated. *Author's summary.*

[1338]. 34.26 : 12.26–8. **Jatobá gum.** *Chemurg. Dig.* 4 (22), 1945 (360). *Repr.* from *Brazil. Bull.* D.S.I.R.

An account of the properties and uses of Jatobá gum, which is collected from *Hymenaea courbaril*, found in the states of Bahia and Mina Gerais, principally near the São Francisco River, Brazil. Soft Jatobá is easily soluble in turpentine. The variety known as Tear or Trapoca, is used, on account of its light yellow colour, in the preparation of colourless, rapid-drying varnishes. It may also be combined with a nitro-cellulose base, if impurities and wax are first removed. Hard Jatobá is resistant to sun, rain, heat and cold, and is used to make a clear varnish for exterior use. It can be mixed with African resins, which are of a still harder composition.

[1339]. 34.26 : 12.26–8 : 12.11.11. WHITE, E. V. **The constitution of Mesquite gum. I. The methanolysis products of methylated Mesquite gum.** *J. Amer. chem. Soc.* 68 (2), 1946 (272–5). C.R.L.

The methyl ether of Mesquite gum has been prepared by treatment of the polysaccharide with dimethyl sulphate and alkali.

Methanolysis of Mesquite gum methyl ether using methanol-hydrogen chloride yields a syrup which is shown to contain 2,3,5-trimethyl - methyl - arabinoside, 3,5 - dimethyl - methyl - arabinoside, 2,4 - dimethyl - methyl - galactoside and 2,3,4 - trimethyl - methyl - glucuronoside. The ratio of the above components was found to be as 1 : 3 : 2 : 1, respectively. The ratio of arabinose to galactose to methoxy-glucuronic acid in Mesquite gum is therefore 4 : 2 : 1.

From these data it is concluded that one molecule of methoxy-glucuronic acid and one of arabinose occupy terminal positions in the repeating unit of Mesquite gum. The remaining units of arabinose are joined by glycosidic linkage at the first and second carbon atoms while the galactose residues are trebly linked at the first, third and sixth positions. *Author's summary.*

[1340]. 34.26 : 12.26–8. RANGANATHAN, S. K., and TANDON, K. G. **Cashew nut shell liquid as a raw material in the paint and varnish industry.** *Paint Technol.* 11 (123), 1946 (94–5). P.R.

The action of sulphur on Cashew nut shell liquid is described. The reaction of 13 per cent. of sulphur with Cashew nut shell liquid yields a resin characterized by its resistance to petrol and water. The value of this resin as a varnish base is demonstrated by the results obtained with it under different test conditions. A table shows the properties of the resins obtained by using varying proportions of sulphur.

[1341]. 34.26 : 12.26–8. **Cashew nut shell oil.** *Bull. imp. Inst., Lond.* 44 (1), 1946 (17–20).

Cashew nut shell oil, which is used mainly for the preparation of synthetic resins, is obtained from the shell of the nuts of *Anacardium occidentale*, which occurs in India,

Portuguese East Africa, Brazil, British East and West Africa, Ceylon, the West Indies and the Philippines. Extraction on a commercial scale is carried on only in India. Some account is given of the various methods of extracting the oil, which contains two phenolic substances, cardol (about 10 per cent.) and anacardic acid (about 90 per cent.).

[1342]. 34.26 : 12.26–8. L'huile de faîne. **[Beech-nut oil.]** *Rev. Eaux For.* 81 (8), 1943 (443–5). [F.]

Report of a discussion at a sitting of the Académie d'Agriculture on the possibility of collecting Beechmast on a commercial scale for the purpose of extracting its oil. Selective breeding for this purpose was suggested. It was generally agreed that, except in times of emergency, the difficulties of collection and extraction, the harm done to regeneration, the slowness of the species in reaching maturity and the irregular occurrence of mast years, would be effective obstacles to such a programme. Figures of yield of oil from the forest of Villers-Cotterêts in 1892 were cited. The oil content of the nuts is 15–17 per cent.; one hectolitre of nuts produces 10 litres of oil. Beech forest 150 years old would produce about 50 hectolitres per ha.

[1343]. 34.26 : 12.26–8 (62.4). GRINDLEY, D. N. **Investigation of the seed oils of some Sudan Caesalpinioideae.** *J. Soc. chem. Ind., Lond.* 65 (4), 1946 (118–9). P.R.

An examination was made of the seeds of *Erythrophleum guineense*, *Parkinsonia aculeata*, *Cassia fistula*, *Tamarindus indica* and *Cassia arereh*. The seeds of this sub-family have a very low content of fixed oils, which are highly coloured and contain a high proportion of unsaponifiable matter. In most cases the mixed fatty acids contain about 30 per cent. of saturated acids, the balance being a mixture of oleic and linoleic acids, the amounts of the two latter varying with the species. In all cases, fatty acids of high molecular weight were shown to be present, a fact that appears to be a characteristic of all the Leguminosae. *From author's summary.* [Cf. *For. Abstr.* 7 (No. 904).]

[1344]. 34.26 : 12.26–8. PENFOLD, A. R., and MORRISON. F. R. **Guide to the extraction of *Eucalyptus* oil in the field.** *Bull. technol. Mus. Sydney* No. 4 (4th, revised ed.), 1945. pp. 24.

The bulletin is intended to be a practical guide for people in New South Wales who intend to undertake the distillation of *Eucalyptus* leaves for essential oils as a commercial proposition. The selection of a suitable area is discussed, and the conditions of the licence issued by the New South Wales Forestry Commission are given in full. The importance of the correct identification of species is emphasized and some illustrations are included. Water supply, transport and market conditions are discussed and types of still and methods of distillation are described.

[1345]. 34.26 : 12.26–8 (81). **Oiticica oil.** *Bull. imp. Inst., Lond.* 44 (1), 1946 (15–6).

Oiticica oil, used in the manufacture of varnishes, is obtained from the seeds of *Licania rigida* (Rosaceae) which is indigenous in the north-eastern part of Brazil, especially along banks of streams and in the lowlands. The tree is rather slow-growing and often reaches 75–100 ft. It fruits after 7 years of age and the yield of seed per tree is estimated at 1–1½ cwt. per annum. The kernels (which form 70–72 per cent. of the fruit) contain 60–65 per cent. of oil. The entire source of seed at present is wild trees but research is being carried on with a view to adapting the tree to other than alluvial soils. To prevent the establishment of plantations outside Brazil, the Brazilian Government forbids the export of seeds for propagation purposes. Several plantings have been made in the West Indies, but no fruit has been produced.

[1346]. 34.26 : 12.26–8. MCVAUGH, R. **Economic plants of interest to the Americas: oiticica and chia oils.** Office of Foreign Agricultural Relations, U.S. Department of Agriculture. [1943?] pp. 13.

An account is given of *Licania rigida* and of experiments in grafting it made in Brazil. It is concluded that large-scale plantations would be a risky investment, since other quick-drying oils might well have been discovered before they came into bearing.

[1347]. 34.26 : 12.11.1. FERRAND, M. Observations sur les variations de la concentration du latex *in situ* par la microméthode de la goutte de latex. **[Observations on the**

variation in concentration of latex *in situ* by microscopic examination of a drop of latex.] *Publ. Inst. nat. Étude agron. Congo belge* No. 22, 1941. pp. 33. [F.f.]

The studies on which this article is based were made on several clones of *Hevea brasiliensis*.

By microscopic examination of drops of latex taken direct from the tree, it is possible to study the concentration of the latex *in situ* and to follow the modifications it undergoes as a result of internal and external factors. Commercially collected latex has only 60–70 per cent. of the concentration of latex *in situ*. The concentration of latex *in situ* was, on an average, higher in trees of 10 years or more than in young ones, but the differences between individuals were much greater than those between age groups. Considerable variation in concentration was observed according to meteorological conditions. In general it seems that conditions unfavourable to physiological vegetative activity (the darkness of night, cloudy weather, persistent cold winds) increase the concentration of latex. On the other hand, the high temperatures and strong illumination which favour physiological activity, diminish the concentration of latex.

34.27. Seeds. Fruits. Leaf Fodder. Fibres and Flosses

See also *For. Abstr.* 8 (No. 1316).

[1348]. 34.27 : 12.11.22 (54.7). GARGE, R. N. **Introduction of grafting in natural regeneration.** *Indian For.* 72 (3), 1946 (114–5). [East Khandesh Forest Division.]

The author recommends grafting of coppice shoots of fruit trees in clear-felled forest areas where such trees abound naturally and where marketing facilities exist, in order to supplement the revenue from lands otherwise producing only fuelwood. He takes as an example the scrub (*Acacia catechu*) forest of the Jalgaon Range in east Khandesh, Bombay, which contains a considerable percentage of Ber (*Zizyphus jujuba*), the grafted variety of which bears a readily marketable fruit.

[1349]. 34.27 : 12.26–8 (79.4). WOLF, C.B. **California wild tree crops.** Rancho Santa Ana Botanic Garden, California. 1945. pp. [ii] + 68. P.R.

Investigations on crop production, probable values and possible utilization of a number of wild tree crops of California have been carried on during the past two years by Rancho Santa Ana Botanic Garden. The important trees studied were: California Buckeye (*Aesculus californica*), Tan-Bark-Oak (*Lithocarpus densiflora*), Coast Line Oak or Encina (*Quercus agrifolia* and variety *oxyadenia*), Golden-Cup or Canyon Oak (*Q. chrysolepis*), Blue or Douglas Oak (*Q. douglasii*), Garry or Oregon Oak (*Q. garryana*), Kellogg or California Black Oak (*Q. kelloggii*), Roble or Valley Oak (*Q. lobata*) and Joshua Trees (*Yucca brevifolia* and variety *jaegeriana*).

Frequency and amount of crops produced, harvesting, potential feed values, drying and storage were studied. Most of the seeds or fruits investigated appear to be most valuable as sources of high carbohydrate fodder for stock, or perhaps for industrial uses, and are not likely to be of any significance for human food. However, acorns of Coast Live Oak, Kellogg Oak and seeds of the Joshua trees are high in good edible oils and are thus potential sources of thousands of tons of human food. From the better stands of *Yucca brevifolia* about 500 to 1,000 lb. of fruit per acre can be obtained. The seeds contain over 34 per cent. of oil and a fair amount of protein. They yield about 600 lb. of oil per ton, leaving a residue like wheat bran in composition. The ground pods also produce a fair fodder. A ton of fresh acorns from Coast Live Oak (var. *oxyadenia*) yields approximately 300 lb. of oil and 1,400 lb. of acorn oil meal.

[1350]. 34.27 : 12.26–8. WOODMAN, H. E., and EVANS, R. E. **The Horse-Chestnut as a source of food for livestock. I. The composition, digestibility and nutritive value of alcohol-extracted Horse-Chestnut meal, water-extracted Horse-Chestnut meal and Horse-Chestnut residue. II. The value of alcohol-extracted Horse-Chestnut meal, water-extracted Horse-Chestnut meal and Horse-Chestnut residue as a partial substitute for cereals in the rations of bacon pigs.** *J. agric. Sci.* 36 (1), 1946 (29–55). [School of Agriculture, Cambridge.] O.R.E.

[1351]. 34.27 : 12.26–8 : 23.23.15. **Treating and storing chestnuts for eating and for seed propagation.** Agricultural Research Administration, U.S. Department of Agriculture. [1943?] pp. 2.

[1352]. 34.27 : 12.26–8. NANJI, H. R., SAVUR, G. R., and SREENIVASAN, A. **Tamarind seed 'pectin'.** *J. sci. industr. Res., India* 14 (5), 1945 (129–30). [Department of Chemical Technology, Univ. of Bombay.] L.S.

A comparison is drawn between the chemical and physical properties of pectin produced from Tamarind seed and other pectic substances, the chief source of which are cider and citrus waste residues. Pectin from the Tamarind seed shows important differences, which are detailed in the article, and it is suggested that it may not be a pectin as the term is ordinarily understood.

[1353]. 34.27 : 12.26–8. HAFEL, H. **Preparation of pectin from press residues of Mountain Ash berries by hydrolysis.** *Norw. Patent* No. 69,651, Oct. 15, 1945. Chem. Abstr. 40 (8), 1946 (2244). P.R.

Pectin is obtained from Mountain Ash [*Sorbus aucuparia*] berries by fractional extraction of the dried press residue with pure ash-free water, the pH value being 3·5–4 according to the substances present in the residues. Preferably the extraction takes place in four stages, the first and second at 90–100° for 30 minutes each, and the third and fourth in an autoclave at an excess pressure of 0·4 kg. for 5 minutes each. The combined filtrates are evaporated *in vacuo* at a temperature below 55° and precipitated with acid EtOH. The product has optimum gel-forming properties at pH 2·25–2·50.

[1354]. 34.27 (945) : 11.62.11. WEBB, C. G. **Native trees and shrubs as feed for stock.** *J. Dep. Agric. Vict.* 43 (3), 1945 (101–7). L.S.

Grazing of scrub country in Victoria is usually a temporary expedient, and is almost wholly confined to the Mallee district. A brief review is made of the vegetation of the Mallee district, with notes on the suitability of various shrubs and trees for fodder. Some species of this district have their commercial uses, but are not of great value. Murray Pine (*Callitris glauca*) and Belar (*Casuarina cambagei*) are used for fencing and farm buildings but are susceptible to rot. The question of soil conservation and the effect of constant grazing upon the control of erosion is also discussed.

[1355]. 34.27 : 12.26–8 : 3 : 23.27. HEWITT, A. C. T. **Weeping willows.** *J. Dep. Agric. Vict.* 43 (4), 1945 (155–6). L.S.

The Weeping Willow (*Salix babylonica*) is recommended for planting on pastoral and dairy farms in Victoria. It is useful for checking soil erosion and filling up gullies, and provides shade for stock in summer. The wood makes a good but quick-burning fuel. Boughs about 9 ft. long and 3 in. in diameter are usually planted. As soon as Willows become established they check the flow of water down gullies, which gradually fill up. On very flat country, Willows may block the flow of water too much and cause undue flooding. One of the greatest values of the Weeping Willow is that it provides an excellent reserve of green

	Weeping Willow		*Mixed pasture*	
	Leaves only	*Leaves and twigs*	*Succulent*	*Flowering*
	Chemical analysis			
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Moisture	68·0	68·0	80·0	75·0
Ash	3·0	2·4	2·3	2·1
Crude protein	7·5	5·2	5·6	3·7
Crude fat	0·9	0·7	1·1	0·9
Crude fibre	3·8	8·2	3·2	7·1
Carbohydrate	16·8	15·5	7·8	11·2
	Food values			
Starch equivalent	18·0	18·0	14·0	14·0
Protein equivalent	5·1	3·4	4·5	2·2

feed for stock in the summer, when pastures are dry and other green feed is scarce. Stock eat every leaf and fine branch hanging within reach, and during droughts many Willows are lopped for fodder. They stand frequent and severe lopping, but it is advisable not to lop them during good seasons. The chemical analyses and food values of Weeping Willow leaves, and of leaves and green twigs up to ¼-in. in diameter are given in the table opposite. It is estimated that up to 20 lb. a day can be fed with pasture hay to each dairy cow, with good results.

[1356]. 34.27 : 12.25 : 12.14.5. FONDEUR, D. Le pin maritime, plante textile. [***Pinus pinaster* as a textile plant.**] *Rev. Eaux For.* 80 (2), 1942 (99–104). [F.]

Description of a process for producing usable fibre from Pine needles, developed by a firm at Aulnay-sous-Bois (Seine), which before the war manufactured various products from asbestos. When supplies of asbestos failed, tests were made with various substances and it was found that fibre obtained from Pine needles had the necessary qualities of lightness, non-conductivity of sound and heat, and capacity for being spun and even woven. The machinery used for working with asbestos could be used on the new material, 'Pin Tex', after slight adjustments. The process of extracting the fibres is partly chemical and partly mechanical. The needles pass successively through various acid or alkaline baths at boiling point, which remove the resins, salts, tars and oils, and leave nothing but the cellulose in the needles. The mechanical process is much the same as that used on other textiles. The yield is 60 per cent. by weight. The material is used as a substitute for asbestos in many applications, but can also be mixed with wool or cotton, in proportions of 40–50 per cent. of the manufacture of yarn. Researches were in progress on methods of recovering the by-products and chemicals. Both green and dry needles can be used, but the latter are easier to collect and to treat. In order to safeguard the stands in which they are collected, regulations were laid down for the precise methods to be employed. No collection was allowed under stands less than 30 years old. The amount to be collected was fixed at 0·5 kg. per sq. m., or 5 tons per ha., which is estimated to be the amount of the annual fall of needles. [Cf. *For. Abstr.* 6 (186, 253).]

[1357]. 34.27 : 12.29. CORMIO, R. Si devono spogliare i '*Chamoerops*' anche dei breve monconi di gambi di foglie? [**Should the short fibres be stripped from leaf stalks of *Chamoerops*?**] *Repr.* from *Giardini* No. 10, 1942. pp. 5. [It.] X.

The proposed stripping of fibres from Palms in Italy, in order to provide material for textile manufacture is condemned, as likely to lead to the death of the trees in winter frosts.

[1358]. 34.27 : 12.29 : 33.32.4. SCHUELER, G. B. E. **Uses of cocoanut products.** *Mod. Plastics* 23 (10), 1946 (118–9). P.R.

Three fillers for the plastics industry can be supplied by the coconut industry—coconut flour from the shell, coir dust, and fibres. The properties of coconut shell flour are compared with those of walnut shell flour, which they resemble. Coconut shell flour requires less resin than most other fillers and has a high density. Properties of phenolic moulding compounds made with the shell flour are tabulated. Coir dust is 20 per cent. lighter than wood flour and is more highly water-absorbent than the fibres. Experimental moulding with coir dust as the only filler proved to be brittle. It is suggested that coir dust could be used with advantage with another compact, non-absorbent filler. Coconut shell fibres have been little used in the plastics industry, but in India they have been used with shellac as a binder to make fibre boards.

34.28. Heather

[1359]. 34.28 : 12.26–8 : 34.24 : 33.38 (44). TASSION, M. La brande ou bruyère. [**Heather or Heath.**] *Rev. Eaux For.* 81 (3), 1943 (78–81). [F.]

Considerable quantities of Heather are extracted from the forests of south-west France (45,000 stères per month from the 28th and 29th working circles), and used as fuel. The heather is rooted out, and the rootstocks crushed in special apparatus of the 'Broyeur' type. The tops are used mainly for kindling. The average monthly production means the clearing of 500 ha. of land, which is then ready for reforestation by direct sowing. Crushed rootstocks can be used instead of anthracite for central heating, and in domestic grates. Charcoal manufactured from Heather is markedly superior to that made from

ordinary wood, owing to its greater calorific power (4,000 calories compared with 2,800 from Pinewood), and is also much cleaner. The root bark of Heather contains tannin in varying proportions. *Erica purpurescens* gives the best yield (8–15 per cent.); the yellow Heather and *Erica scoparia* give 4–10 per cent. The tannins are of the catechuic type, very similar to Argentine Quebracho, and have given good results in experimental tanning.

35. SALE AND DISPOSAL OF FOREST PRODUCTS. TIMBER TRADE

[1360]. 35 (410) : 09.4. GREAT BRITAIN. **Monthly Digest of Statistics.** No. 1, 1946. pp. ii + 95. **Definitions of items and units in the Monthly Digest of Statistics.** 1946. pp. 31. H.M. Stationery Office, London.

The first number of a monthly publication summarizing statistics of various aspects of the economic activity of the United Kingdom. Figures for employment, production and consumption of fuel and power, raw materials, manufactured goods, building, agriculture, trade, transport, etc., are given in the form of time series, where possible for the years 1935 to 1944, and monthly from the beginning of 1944. Of particular interest to the timber trade are statistics of the production and consumption of softwood and hardwood, pitwood and plywood, and paper-making materials; imports of timber and exports of manufactures of wood and timber; and the numbers employed in woodworking industries. With this number is issued a supplement giving detailed definitions of the units of measurement and the terms employed.

[1361]. 35 (494 : 44) : 33.51. LANZ, C. Du bois de mine suisse dans les charbonnages français. **[Swiss mine timbers in French collieries.]** *Schweiz. Z. Forstw.* 97 (7), 1946 (324–7). [F.]

Since the winter of 1942–43 Swiss forest owners have been supplying increasing quantities of pitprops both for use in Switzerland and for export to France (and also to Hungary) in exchange for coal. The quantities of wood exported and coal received were:—

	Wood	*Coal*
1943	10,900 cu.m.	19,400 m. tons
1944	9,700 „	12,000 „
1945	25,200 „	34,100 „
	45,800 „	65,500 „

In 1945–46 about 60,000 cu.m. of pitwood is to be exported to France, the exchange to be made on the basis of 1 cu.m. of wood for 1·2 metric tons of coal, representing a calorific gain of about 300 per cent. for Switzerland. In view of the greater efficiency of coal for industrial heating, it is estimated that 1 cu.m. of exported pitwood replaces 6–8 stacked cu.m. of coniferous fuelwood.

Notes are included on the author's visit to a mine in the St.-Étienne basin.

[1362]. 35 (481) : 82. **Norway's problem: measures to increase timber output.** *Timb. Tr. J.* 177 (3641), 1946 (940).

Timber and pulpwood production in Norway are held up by shortage of labour in the woods. There are at present about 26,000 fellers at work, but about 6,000 more are needed as well as about 1,000 other woodmen. The production of timber for sale fell from 5·4 million cu.m. in 1940–41 to 4·7 million cu.m. in 1944–45. The basic price per cu.m. of sawn timber delivered alongside river or main road, rose from about 19·4 kr. in 1937 to 23 kr. in 1944, and 31 kr. in the early part of 1946. Average wages of a forest worker during the winter increased from 3·77 kr. per day in 1933–34 to 5·41 kr. in 1938–39 and 11·98 kr. in 1944–45. The corresponding figures for a lumberman with his horse are 6·38 kr., 8·84 kr., and 20·61 kr.

[1363]. 35 (73). HOPKINS, H. **Accomplishments of the timber production war project.** *J. For.* 44 (5), 1946 (330–4). [U.S. Forest Service.]

An account of the organization, objectives, and achievements of the U.S. Timber Production War Project, by the director of the project.

[1364]. 35 (73) : 97.4. **Present lumber situation in the United States and possible measures to increase supply.** *J. For.* 44 (5), 1946 (317–25). [Division of Forest Economics, U.S. Forest Service.]

A report prepared by the Division of Forest Economics, Forest Service, U.S. Department of Agriculture. The two main points are that the shortage of lumber will be of long duration, and that the principal obstacle to increased production is shortage of suitable and accessible stumpage. Immediate remedial measures include opening up additional National Forest timber by access roads, and a programme to increase output of small sawmills in the East. Recommended long-term measures are designed to build up and maintain forest productivity on a much higher level than at present.

[1365]. 35 (73) : 8 : 90. FOSTER, E. **Lumber snafu.** *J. For.* 44 (6) 1946 (393–400).

The writer presents an analysis of the American lumber industry from the labour point of view. Despite high prices (211 per cent. above 1914, compared with only 55 per cent. for all commodities) and low wages (54 per cent. receiving less than 65 cents per hour, compared with an average of only 19·5 per cent. for the 17 main industries) relative to other industries, lumber production was below requirements during the war and is likely to remain so during the reconstruction period. Efficiency is characteristically low because more and more of the large producers are closing operations after exhausting their timber supply. To-day small, and often inefficient, mills account for two-thirds of the total lumber produced. Increasing lumber production is, however, consistent with better forestry practice. He advocates a Government programme to provide small timber owners and operators with the same degree of service and aid as is supplied to farmers, together with federal regulation of commercial logging.

[1366]. 35 (73) : 33.4. SHAMES, L. M. **A forecast of lumber demand.**—With comment by F. J. Hallauer. *J. For.* 44 (7), 1946 (477–88).

By analysing the major influences on lumber consumption in the past and projecting the trends into the future, the author forecasts the demand in the United States for the next building cycle (18 years). The peak of the cycle is expected in 1952 or 1953; the trough, 10 years later. A comparison of the central period of the cycle with that of the pre-war cycle leads to the expectation of a 3·6-per-cent. decrease in domestic consumption, but a 5-per-cent. increase in total lumber consumption.

[1367]. 35 (944) : 92 : 31.43 : 13.2. TAYLOR, K. L. **Legislation for control of *Lyctus* in N.S.W.** *Aust. Timb. J.* 12 (1), 1946 (33, 35–7, 39).

The New South Wales Timber Marketing Act, which will shortly come into effect, is principally concerned with the sale of timber susceptible to *Lyctus* attack. The conditions under which sale of such timbers is permitted are described, and their effect on the trade discussed. Notes are given on methods of preservative treatment. Recent research indicates that species such as Spotted Gum [*Eucalyptus maculata*] and Messmate Stringybark [*E. obliqua*], which have narrow sapwood, can be most economically treated by high-ringing the trees some months before they are felled in order to resorb the starch in the sapwood and make it immune. The most promising remedy for all kinds of timber is the boric-acid diffusion treatment. This originally consisted in boiling or simmering the planks in an 8-per-cent. solution of boric acid for some hours, but recent research indicates that cold soaking for a longer period is equally effective and that a weaker solution can be used with lower-density timbers or with increased immersion time. Both these methods confer complete immunity, so that the timber can be sawn and cut up in any way without exposing untreated parts, and there is no danger of future attack by borers except when boric-acid-treated timber is subject to leaching. [Cf. *For. Abstr.* 8 (No. 1145).]

38. FOREST CONSTRUCTIONAL WORKS. ENGINEERING

See also *For. Abstr.* 8 (Nos. 1152, 1154–6).

38.2. *Building Construction. Foundations and Superstructures*

See also *For. Abstr.* 8 (Nos. 1116–7, 1177).

[1368]. 38.2. CRESTIN, F. Les charpentes en lamelles en bois. **[Wooden lamella roofs.]** *Rev. Eaux For.* 79 (6), 1941 (413–22 + plates). [F.]

[1369]. 38.2 : 12.25 : 12.26–8 (77.4). BELL, L. E., and JEFFERSON, C. H. **Using Jack Pine and Popple for farm building.** *Ext. Bull. Mich. St. Coll.* No. 255, 1944. pp. 23.

The use of local low-cost timber for farm constructions in Michigan is discussed. Although Jack Pine and Poplar are considered to be non-durable, they will give satisfactory service if properly sawed, seasoned and protected against decay hazards. Emphasis is placed on the need for high foundation walls, tight joints, steep-pitched roofs, drip caps on doors and windows, and water-tight flashings around chimneys and in valleys.

[1370]. 38.2 : 32 : 82. WALKOM, H. C. **Portable prefabricated panel camps.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 819 (B–3), 1946. pp. 9 + figs.

A portable prefabricated camp for loggers is described. The components are illustrated and instructions for their erection and for the installation of electricity and running water are given. Costs are estimated in the amount of materials and hours of labour needed.

[1371]. 38.2 : 33.15.2 : 31.27. WEXLER, A., NEWMAN, S. B., and PHELAN, V. B. **Structural properties of prefabricated plywood lightweight constructions for walls, partitions, floors and roofs.** U.S. Department of Commerce, National Bureau of Standards. *BMS* 104, 1945. pp. 48. D.S.I.R.

Prefabricated plywood wall, partition, floor and roof specimens of both lightweight stress-skin and commercial design were submitted by the Douglas Fir Plywood Association for testing. The specimens were subjected to compressive, transverse, impact, and racking loads. The loads simulated those to which the elements are subjected in actual service. The deflection under load and the sets after the load was removed were measured for uniform increments of load. The results are presented in graphs and tables. *From authors' summary.*

38.8. *Torrent Training*

[1372]. 38.8. NÈGRE, M. Note sur la correction des ravins dans la série domaniale de Guillaumes (Alpes-Maritimes). **[Note on gully-control in the Guillaumes working section (Alpes-Maritimes).]** *Rev. Eaux For.* 82 (8), 1944 (458–9 + plate). [F.]

4. FOREST INJURIES AND PROTECTION

42. INJURIES FROM INORGANIC AGENCIES, EXCLUDING FIRE

[1373]. 42 : 12.25 : 12.14.3 : 44.3. DAY, W. R. **Root disease in conifers.** *Nature, Lond.* 158 (4002), 1946 (57–8). [Department of Forestry, Univ. of Oxford.]

As an important part can be played by non-biotic factors in the development of root disease, there is need for soils research designed to show 'in what circumstances and with what severity conditions develop in the field which are sub-marginal for healthy root development, either directly or through predisposing roots to infection by parasites'. Illustrations are given showing abnormal zones (consisting of unlignified collapsed tracheids) in the roots of diseased Pines in East Anglia. These abnormal zones occur in parts of the soil profile which are unfavourable to plant growth on account of either drought conditions or water-logging. Evidence indicates that infection by fungi, although possibly of considerable importance in the development of the disease and in killing of the trees, is secondary to strongly adverse physical soil factors.

42.1. *Air Currents*

[1374]. 42.1 (931). JOLLIFFE, W. H. **Wind damage in Canterbury.** *N.Z. J. For.* 5 (2), 1945 (154–5).

The gale which struck Canterbury, N.Z., on 13th July, 1945, was the most disastrous on record. The quantity of timber involved has been estimated at 90 million bd. ft. of which 70 million were classed as millable. The nature of the damage was in most cases complete uprooting, but there was also a varying degree of top breakage which seemed to be greater where the soil was deeper and where early thinning had been carried out. The species chiefly affected was *Pinus radiata* which forms the bulk of the plantations round Canterbury. The older age classes above 35 ft. in height were the chief sufferers; only occasional damage occurred in smaller or younger stands. Cypresses and Cedars showed little damage.

42.2. *Temperature Influences*

[1375]. 42.2 : 12.26–8. SPAULDING, P. **Susceptibility of Beech to drought and adverse winter conditions.** *J. For.* 44 (5), 1946 (377).

Notes on mortality of Beech caused by a combination of severe summer drought followed by unusually cold weather in the winter.

[1376]. 42.21 (74.8) : 11.11.2. CLARKE, W. S. **Effect of low temperatures on the vegetation of the Barrens in Central Pennsylvania.** *Ecology* 27 (2), 1946 (188–9). [Department of Horticulture, Pennsylvania State College.]

In the broad valley of the Barrens of Pennsylvania there are no large Oaks. The chief cover is still scrub Oak, the foliage and new growth being killed back every 2 or 3 years by late spring frosts. Air drainage is cut off by a ridge which forms the lower boundary of the valley, and cold air piles up and accentuates the frostiness of this region. The trees on the hills come into leaf weeks before those in the valley. From a distance the vegetation line looks like a green border above the brown valley. At the border line one can see trees with the tops in leaf and the lower limbs still dormant.

[1377]. 42.21 : 21.8. CHANDLER, W. H. **Trees in two climates.** Univ. of California Press, Berkeley, Calif. 1945. pp. 22.

The first part of this lecture is a detailed review of research into the effect of freezing on plant tissues. Most of the established facts can be explained by a theory that death by freezing is due to rapid, and perhaps uneven, expansion at thawing, of protoplasm that has been made brittle by loss of water. The second part is concerned with the phenomena of dormancy and the need for a period of chilling to break it, and the consequently different behaviour of fruit trees in a climate with a cold and in one with a warm winter.

42.3. *Precipitations*

[1378]. 42.32 (44). NOËL, P. Observations forestières en Lorraine pendant l'hiver 1940. **[Observations in the forests of Lorraine**

during the winter of 1940.] *Rev. Eaux For.* 79 (3), 1941 (189–93). [F.]

Notes on damage by glaze-ice in the winter of 1940. The greatest damage occurred on the edges of stands, along forest roads, in young dense stands and to isolated trees. Conifers in the pole stage broke off half-way up the trunk or just beneath the crown. In a 25-year-old stand of Poplars, 5–6 m. high, 90 per cent. of the trees were broken off.

[1379]. 42.32 : 44.3 (74.7). SPAULDING, P., and BRATTON, A. W. **Decay following glaze storm damage in woodlands of Central New York.** *J. For.* 44 (7), 1946 (515–9). [U.S. Division of Forest Pathology.]

Northern hardwood stands in Otsego and Herkimer Counties, New York, were severely damaged by a glaze storm in December, 1942. Observations made early in 1945 showed that sap-rot had developed at the bases of injured but living Maple and Beech trees. The initial injury appears to be due to sunscald caused by sudden opening of the stands. *Daedalea unicolor* was found to be fruiting on the bases of nearly every sap-rotted tree and was evidently one of the first fungi to attack them. Other fungi were *Peniophora* sp., *Polyporus adustus*, *P. hirsutus*, *P. pergamenus*, *P. tulipiferus*, *P. versicolor*, and *Schizophyllum commune*.

[1380]. 42.33 (44). VAZEILLES, M. Les exotiques et la grêle. **[Exotics and hail.]** *Bull. Soc. for. Franche-Comté* 25 (12), 1946 (453). [F.]

A severe hailstorm, with hailstones of unusual size, did considerable damage to plantations in the neighbourhood of Angers and Brives in August, 1944. Of the hardwoods, Beech suffered most and Oak, Maple and Birch rather less. Most of the conifers proved to be fairly resistant, but Douglas Fir, Japanese Larch, *Abies lowiana* and, in a less degree, Sitka Spruce, were much mutilated. Some of the young plantations of Douglas Fir and Larch will probably have to be replanted.

42.5. *Chemical Influences. Nutrient Deficiencies*

[1381]. 42.5 : 12.26–8 : 11.48.5. DAY, W. R. **The pathology of Beech on chalk soils.** *Quart. J. For.* 40 (2), 1946 (72–82).

A sequence of events in the development of disease in Beech growing on shallow and usually well drained calcareous soils is set out. The origin of disease is found in the physical and chemical nature of the soil, which leads to the development of adverse water conditions in extreme seasons, and to the making inactive of iron, an essential element for plant growth. The development of chlorosis, that is of a deficiency of chlorophyll, is a direct result of the inability to utilize iron. The chlorosis prevents the development or maintenance of a root system adequate to meet the needs of the tree, especially in difficult years. It results in die-back of the crown and root when sufficiently acute, and predisposes the tree to bark disease associated with *Nectria punicea* Wesse, and to root decay and butt rot by *Ustulina vulgaris* Tul. There is also evidence that other adverse soil conditions, probably associated with drought in most cases, lead to the death of roots and predispose trees to butt rot, even if chlorosis is only slight or is absent. Lime-induced chlorosis tends to become acute only after trees have reached some considerable height and size. A possible explanation of this is given, depending on the nature of the soil covering and on the quantity and type of organic matter in the surface layers of the soil. Yew seems to be the natural climax species in places where Beech suffers acutely from chlorosis; but in its absence a succession seems to take place in which Beech becomes dominant, only to become diseased and fail. A pathological climax is thus reached which is inevitable from the nature of the soil and climate and the character of Beech, the recurringly dominant species. *Author's summary.* [Cf. *For. Abstr.* 8 (Nos. 881, 944).]

[1382]. 42.5 : 12.26–8 : 12.11.11. DROUINEAU, G., and GOUNY, P. Sur la catalase des feuilles de *Prunus persica* et ses variations dans les tissus atteints de chlorose spécifique des sols calcaires. **[On the catalase of the leaves of *Prunus persica* and its variations in tissues which are attacked by the chlorosis specific to calcareous soils.]** *C.R. Acad. Sci., Paris* 221 (23), 1945 (709–10). [F.] D.S.I.R.

43. FOREST FIRES

[1383]. 43 : 12.25 : 60.31. BICKFORD, C. A., and CURRY, J. R. **The use of fire in the protection of Longleaf and Slash Pine**

forests. *Occ. Pap. Sth. For. Exp. Sta.* No. 105, 1943. pp. 22.

This paper was prepared for the owners and managers of forest land on which the growth of forest products is the main object. Its purpose is to present a preliminary guide for the improvement of current practice in the use of fire in forest protection. A general procedure for deciding on the wisdom of burning, and for planning and executing plans for the use of fire is described.

43.0. *Predisposing Factors and Causes*

[1384]. 43.0 (71). BEALL, H. W. **Forest fire danger tables (provisional).** *For.-Fire Res. Note Dom. For. Serv.* No. 12, 1946. pp. 73 + figs + charts.

These tables are intended for use in Canada from the Rocky Mountains eastward. They replace tables issued in 1940 [see *For. Abstr.* 2 (243)].

[1385]. 43.0 (71.1). BRITISH COLUMBIA. **Report of the Forest Service: year ended December 31st, 1945.** King's Printer, Victoria, B.C. 1946. pp. 90 + plate.

As a result of earlier investigations it appeared that a more accurate measurement of comparative fire risk would be obtained by watching the progress of a drying cycle as indicated by fuel moisture content in the early morning hours at hillside locations and by relating to it the *intensity* of the drying cycle as measured by maximum night humidity recovery. Ten locations on the Lower Coast and Fraser Valley were selected as indicating stations where fuel moisture was read every daylight hour and humidity measured on recording hygrographs or hygrothermographs. In addition, rainfall was recorded and maximum and minimum thermometers established to determine the temperature difference between hillside and valley. During periods of extreme fire risk, night temperatures at hillside stations were higher than in adjacent valleys, with a maximum difference of 20 degrees on 7th July and 20th August. Relative humidity at hillside stations during such periods was consistently low. Fuel moistures at 8 a.m. were directly related to maximum humidities prevailing during the night hours. The correctness of the basic principles of this method of interpreting forest-fire danger was thus established during 1945. Points which still require investigation are:—

(1) At what level does the benefit from night humidity become ineffective?

(2) At what level does the inflammability condition reach an extreme point, or is this a function of individual drying cycles, wherein this level varies with each cycle?

(3) What area is liable to be influenced by an extreme drying cycle as indicated by one indication point? (pp. 65–66).

[1386]. 43.0 (71.21). BEALL, H. W. **Forest fires and fire-hazard records in the mid-west national parks.** *For. Chron.* 22 (2), 1946 (135–7). [Dominion Forest Service, Ottawa.]

Figures are given showing relation between number and size of fires and the degree of fire-hazard measured by the Wright system, based on 6 years' data from two typical forested areas in Manitoba and Saskatchewan. *Extreme hazard* was recorded only 6 per cent. of the time, but 50 per cent. of all the fires started when hazard was extreme and these fires were responsible for 69 per cent. of the total area burned. *High hazard* occurred 17 per cent. of the time, and 25 per cent. of fires started in high hazard and burned 29·6 per cent. of the total area. *Moderate hazard* existed 27 per cent. of the time, and under these conditions 19 per cent. of fires occurred and accounted for 1·3 per cent. of the area burned. *Low hazard* was recorded 37 per cent. of the time, but only 6 per cent. of fires occurred where hazard was low, and they burned only 0·1 per cent. of the total area burned. *Nil hazard* occurred 12 per cent. of the time, and no fires were recorded under these conditions. Three-quarters of all fires, accounting for 98 per cent. of the burned area, started on days of high or extreme hazard, although such conditions were recorded for less than one-quarter of the time.

43.1. *Protective Measures*

[1387]. 43.1 (71.4). BERNIER, G. H. **Forest protection in Quebec during 1945.** *Pulp Paper Mag. Can.* 47 (5), 1946 (94, 98).

The statistics of fire losses during 1945 indicate a total of 996 forest fires covering an area of 43,688 acres. Of these 996 fires, 370 were imputable to berry pickers or to surface

burning to improve berry crops; 84 to smokers; 40 to lunch fires or smudge fires for chasing away mosquitoes; 25 to slash burning (other than settlers' slash burning); 25 to chimney fire or stove-pipe fires or house fires; and 22 to fishermen and hunters. By far the largest number and acreage of fires occurred in August (532 fires, covering 28,405 acres). More than two-thirds of the total acreage burned was the result of only 20 large fires. A control of wild-berry picking in forested areas was initiated during the year. An order-in-council was proclaimed, which made it necessary for berry pickers to secure a berry-picking permit and to comply with all the regulations attached to the permit, and fire rangers were posted to patrol the picking areas and enforce the regulations.

[1388]. 43.1 (73). **Unit protection by air control.** *Fire Control Notes* 7 (1), 1946 (3–5). [Northern Region, U.S. Forest Service.]

A thorough test of aerial detection of fires combined with smoke-jumping patrol has proved successful in the Continental Unit of the national forests of Region 1, U.S.A., which embraces 2,054,000 acres of remote and inaccessible forest land with elevations ranging from 4,000 to 9,000 ft. Inaccessibility and the heavy manning required to give adequate ground-crew protection, together with the small number of man-caused fires, made it an ideal unit for development of fire control by aerial methods. Forty-three look-out posts were discontinued and the money so saved was set aside for flying patrol, training smoke-jumpers, etc. In the 1945 season there were 29 fires of which 18 were class A, 8 class B, and 1 each classes C, D, and E. All but 5 were attacked from the air. Lightning caused 27 of the fires, a camper 1 and the other was started by an automobile exhaust in a high wind. Of the 29 fires 14 were discovered by aerial observers, 7 by look-outs, and 8 by others. Of the fires controlled with less than 10 acres burned, 4 were potentially dangerous. One fire, on which discovery, report, and first action took only 47 minutes by air control, had an average perimeter increase of 4·4 chains per hour and would have taken ground forces at least 6 hours for a first attack. It has been demonstrated that better protection in such areas as the Continental Unit can be obtained, with an actual saving in money, by substituting aerial control for look-out men.

[1389]. 43.1 (94). **Fighting forest fires with planes in Australia.** *B.C. Lumberm.* 30 (3), 1946 (81, 83).

Notes on the use of aircraft for spotting and reporting fires in Australia. In Victoria and New South Wales the Forestry Commissions have made arrangements for the co-operation of the R.A.A.F. When the Forestry Commission reports that it is a critical period for a given area, R.A.A.F. aircraft from the most suitable base go out on patrol, and reports on fires are relayed to the ground organization. In South Australia the police are directly responsible for all bush fire-fighting, and they have enlisted the aid of civil airways companies to report by radio any fire or smoke seen during flights. Aerial patrols are not considered necessary in Queensland, where no forest areas are greater than 100,000 acres, and all are covered by look-outs.

[1390]. 43.1 (94). **Aeroplanes aid Australian fight against bush fires.** *Fire. Prot. Accid. Prev. Rev.* 9 (68), 1946 (220–1, 241). P.R.

[1391]. 43.1 : 07.7. CARSTARPHEN, M. M. **North Carolina flame thrower.** *Fire Control Notes* 7 (2), 1946 (31–2).

Description of an improved flame-thrower attachment for back-pack pumps, developed by the North Carolina Forest Service.

[1392]. 43.1 : 07.7. SQUIRES, J. W. **The Florida drip torch.** *Fire Control Notes* 7 (2), 1946 (39–40).

Description of a torch used for backfiring during prescribed burning operations, with which one man is said to be able to work at the rate of 5–7 miles per hour, as compared with the usual 2–3 miles per hour. The model at present in use at the Southern Forest Experiment Station, Olustee, Florida, was made of a gallon paraffin tin with a spout about 24 ins. long made of copper tubing. The end of the spout was filled with a wick just tight enough to let the fuel drip slowly when the spout was lowered. The first tests were run with paraffin mixed with 1 quart of burnt motor oil and gave fairly good results. Later, petrol was used with motor oil, and, contrary to expectations, appears to be safe, two models having been thoroughly tested by the U.S. Bureau of Standards, who, however, recommended the addition of a check valve air

vent on the can and a loop in the spout as further safety precautions. So far 100 of the gallon drip type of torch have been built and used without accident.

[1393]. 43.1 : 07.7. PRICE, C. E. **Canvas gravity intake.** *Fire Control Notes* 7 (2), 1946 (33–4).

Description of a simple canvas funnel intake for a gravity water supply, which can be quickly installed in irregular stream beds.

[1394]. 43.11 : 07.7. **The beetle tractor.** *Fire Control Notes* 7 (2), 1946 (1–3).

Account, with specification, of a light (1,800-lb.) machine with bulldozer attachment, for use in maintaining and keeping clear forest tracks.

[1395]. 43.13 : 07.7. HOWARD, A. **Gravely fire-line broom.** *Fire Control Notes* 7 (1), 1946 (24–5).

The Gravely tractor, manufactured by the Gravely Motor Plow and Cultivator Co., Dunbar, W. Va., is a small two-wheel rubber-tyred garden-type tractor, with 5 or 6 different attachments such as plough, mower, rotary broom, etc. During the 1945 spring fire season it was used in initial attack on 2 class-C and 3 class-B fires. The indirect method of attack was used on all fires, and rate of spread determined the distance between line and edge of fire. The machine was of little or no use in short grass and weed fields or dense hardwood reproduction, but constructed very satisfactory fire lines in fully stocked or open upland hardwood and hardwood/Pine types, doing the equivalent work of 4 well trained men with hand tools.

[1396]. 43.13 : 07.7. MURPHY, P. H. **Rotary fire mop.** *Fire Control Notes* 7 (1), 1946 (30–1).

Description of a device designed for the suppression of flame in grass or stubble-type fuels on relatively open fields or range, but equally applicable to flame of this type in standing timber. The rotary mop is propelled along the flame line like a lawn mower and in the hands of an energetic operator can suppress flame much faster than conventional hand tools. Model 5–15–A weighs about 23 lb. and has an over-all length of about 72 in. and width of 17 in. The 6 flaps have each a surface area of about 180 sq. in. Patent has been applied for. The cost is $24.50.

[1397]. 43.13 : 07.7. KENYA. **Forest Department annual report for the year 1944.** Govt. Printer, Nairobi, 1946. pp. 13.

The experimental use of stirrup pumps, and particularly a Canadian Wajax hand pump with portable water carriers, proved valuable in enabling fighters to get at fires otherwise too hot to approach and in extinguishing burning logs and stumps, which are always liable to restart a fire and have to be watched for days (p. 3).

43.3. *Fire Damage*

[1398]. 43.3 : 56.02 : 12.26–8. JEMISON, G. M. **The effect of basal wounding by forest fires on the diameter growth of some southern Appalachian hardwoods.** *Bull. Duke Univ. Sch. For.* No. 9, 1944. pp. 63 + plates.

Measurement of growth on sections and increment cores showed that even severe fire wounding does not decrease the rate of diameter growth of Yellow Poplar (*Liriodendron tulipifera*) and White Oak (*Quercus alba*) trees. On one severely burned area of poor site quality, Scarlet Oak (*Q. coccinea*), one of the most easily injured species, grew significantly slower after wounding (0·024 in. less in diameter in a year). Less precise exterior measurements of Scarlet Oak on permanent sample plots in N. Carolina and Georgia showed a slower rate of diameter growth for trees with large wounds; in some cases up to 0·16 in. per year less than unwounded trees. Analysis of foliage for nitrogen, mineral and moisture contents and of roots for carbohydrate content failed to show that a fire wound obstructs upward movement of the former group or downward translocation of the latter substances except, again, for Scarlet Oak. Trees of this species with large wounds had less nitrogen in their foliage than trees with small injuries, but little physiological significance is attached to this finding. Apparently, anatomical changes in phloem and xylem near fire wounds explain the lack of statistically significant deficiencies of raw materials and food in crown and roots. Elements of these tissues quickly become oriented with their long axis in such a direction as to favour passage round the wound. The temporary obstruction is thus circumvented by new translocation and conduction paths. The slower growth of some wounded Scarlet Oaks

is probably caused by the crown injury that accompanies fire wounding in a severe fire. It is concluded that growth rate of individual surviving trees is affected but little by fire, but net growth of stands is reduced materially by mortality consequent upon fire. *From author's summary.*

44. DAMAGE BY HARMFUL PLANTS. VIRUS DISEASES

44.1. *Forest Weeds*

[1399]. 44.1 (54.87). CEYLON. **Silvicultural research: Ceylon: 1944.** Office of the Conservator of Forests, Colombo, Ceylon. 1946. pp. 16.

Teak sample plots of the Eastern division, which have a rank growth of Illuk (*Imperata cylindrica*), are subject to annual ground fires which tend to increase erosion, and the Illuk itself has a markedly debilitating effect on the Teak. These effects become more pronounced when thinnings are eventually carried out in plantations which had previously been underthinned. In one young stand, serious die-back and death of many trees have followed a relatively light thinning of about 20 per cent. *Gliricidia maculata*, which has proved very helpful in controlling Illuk in the intermediate climatic zone of the Island, is not nearly so satisfactory here. An indigenous undershrub, *Flemingia strobilifera*, is being tried (p. 3).

[1400]. 44.1 : 12.26–8. STÅLFELT, M. G. Gifteffekten och dess beroende av spridningssättet vid utrotning av ljung och blåbärsris med klorat. **[The influence of method of application on the poisonous effect of sodium chlorate in the eradication of Heather and Blaeberry.]** *Repr.* from *Medd. Skogsforskn-Inst.* [*Skogsförsöksanst.*] *Stockh.* 35 (2), 1946. pp. 12. [Sw.e.]

Complete killing of the aerial parts of *Calluna vulgaris* and *Vaccinium myrtillus* is obtained only if sufficient poison adheres to the stem base to prevent sprouting. Owing to differences in adherence, finely divided was found to be more effective than coarse sodium chlorate, but the best kills were obtained with a concentrated solution applied as a fine spray, in which form 20 cc. of solution are sufficient for 1 sq. m. The plants are most sensitive to the poison at the end of May, just after flushing; they are also more sensitive in summer than in autumn, especially if the salt is distributed in solid form. Only in summer, and only with application by spraying, was there a regular correlation between effectiveness and the amount of salt used: with autumn and winter spraying, and with all applications in solid form, the poisoning was irregular owing to factors such as precipitation and leaching, lodging of the salt in moss and litter, etc. The great sensitiveness of the plants to the poison in early summer is interpreted as a consequence of scanty precipitation, little available soil moisture and strong transpiration from the new leaves, conditions which tend to create a water deficit in the cells and favour the entry and translocation of the salt.

It is pointed out that with applications in finely divided solid or spray form, the risk of poisoning domestic animals, at least after a few days have elapsed, should be very small. Fire danger is probably significantly increased only when chlorate is applied to dry and already inflammable material. [Cf. *For. Abstr.* 7 (Nos. 1403, 2030–2).]

[1401]. 44.1 : 12.26–8 : 56 : 12.25. SJÖSTRÖM, H., and HELLICHIUS, H. Klorat som hjälpmedel mot skogsmarkens förvildning genom ljung. **[Chlorate for the control of degeneration of forest land by Heather.]** *Svenska SkogsvFören. Tidskr.* 44 (2), 1946 (168–81). [Sw.sw.]

(i) Where Heather (*Calluna vulgaris*) dies out from natural causes, growth reactions in trees may resemble those after chlorate treatment. In about 1938 some unknown agency caused Heather to die out in parts of upper Dalarna on areas often 1 ha. or more in extent. Increment cores taken in 1945 from 200-year-old Scots Pine in open stands on adjacent affected and unaffected areas, showed a marked improvement in diameter growth for trees on the former, dating from 3–5 years after the death of the Heather and apparently not attributable to any cause other than a green-manuring effect from the dead roots and possibly the elimination of competition, no fresh Heather having come in during the 7 years in question. Though, owing to the presence of heavy lichen cover throughout, there was not significantly more regeneration on the affected area, such regeneration as did exist was greener and healthier in appearance and was making better height growth than that on an adjacent unaffected area.

(ii) After a partially successful trial of potassium chlorate in Kloten Crown Park in 1942, further trials were begun in 1944 with the chief aim of comparing methods of application of sodium chlorate for eradicating very heavy Heather growth in the same area and in Stadra Crown Park. At Stadra the treatments (mid- to late October) and results (judged one year later) were: (*a*) powdering at 76 kg./ha., 35-per-cent. kill; (*b*) very fine spray, applied with a back-packing sprayer at the equivalent of 66 kg./ha. in 40-per-cent. aqueous solution (percentage by weight), 80-per-cent. kill; (*c*) as (*b*), but against weaker Heather with a greater admixture of Crowberry, 100-per-cent. kill. In the Kloten area (beginning of November) applications (*a*) in crystal form at rates of 40–60 kg./ha. were practically complete failures, doubtless because the vegetation was dry; (*b*) as a spray of 36-per-cent. aqueous solution, at a rate equivalent to 100 kg./ha., gave a 100-per-cent. kill.

(iii) The costs of continued experiments in the Kloten area in 1945 are summarized in the following table:—

Method of application	*Total area treated (ha.)*	*Chlorate consumption*		*Cost*	
		Total (kg.)	*Kg. per ha. of total area*	*Total (kr.)*	*Kr. per ha. of total area*
Dry powder, applied with 'Fosfatbolagets klorexspridare' . .	25·9	1,890	73	1,542	60
Wet spray, applied with 'TT' sprayer	48·0	2,765	58	2,412	50

Calculated by the actual area of Heather patches treated, however, it is probable that the rate used in both treatments was about 80 kg./ha. Though it is too early for final conclusion on these trials, there are strong indications that summer is the best time for treatment; the later the treatment in the autumn, the longer was the period for the appearance of symptoms of damage, in spite of increasing rates of application. This agrees with the results of Stålfelt [cf. preceding abstract] and Bøhmer [*Tidskr. Skogbr.* 1929] and points to the possibility of reducing rates per ha. by early treatment.

(iv) If water is available at no great distance, spraying is not more expensive than dry applications, is less dependent on weather, allows rates per ha. to be adjusted with ease by varying the strength of the solution, and gives readier control, as the spray is more easily directed to treat or to avoid any given patch of vegetation. It is noted that at Stadra no Pine seedlings showed noticeable damage from the dry applications, whereas seedlings not deliberately avoided by the spray were burned.

[1402]. 44.1 : 12.26–8 : 12.19.23 : 31.1 : 31.23 : 12.11.11 : 11.44 : 11.47.21 : 11.41.1.
MORK, E. Om skogbunnens lyngvegetasjon. **[On the suffruticose vegetation [*Calluna, Vaccinium*, etc.] of forest land.]** *Medd. norske Skogforsøksv.* 9 (3) (Ser. No. 33), 1946 (269–356). [Nor.e.]

(i) Distinguishing features of the woods of *Vaccinium myrtillus, V. uliginosum, V. vitis-idaea, Empetrum hermaphroditum* and *Calluna vulgaris* are discussed and illustrated. In general, the woods of these species are characterized by very short tracheids and libriform cells, and are heavy.

(ii) Data from practically pure old communities of the *Vaccinia* and *Calluna* show that about half of the dry weight of the plants is situated in the humus layer, which is interwoven with stems and roots. Further data from 5 forest types of the Ulvsjøberg indicate that both dry weight of aerial parts and annual litter production decrease in the order: *Calluna* type, *Empetrum* type, *Vaccinium uliginosum*/*Calluna* bog-forest type, *Vaccinium* type, *Myrtillus* type. The *Calluna* type had a dry weight per ha. (aerial parts) of 14,400 kg. and an annual litter production per ha. of 2,600 kg., corresponding figures for the *Myrtillus* type being 5,400 and 800 kg. per ha.

(iii) Results of chemical analyses are presented and it is emphasized that composition varies widely in different parts of the plants, e.g. the content of mineral constituents such as CaO, K_2O and P_2O_5 is highest in leaves of the year and lowest in the underground portions,

whereas the reverse is true of lignin content. Leaves of the species examined had high sugar contents (14–18 per cent. of the dry weight), and those of *Empetrum* were characterized by a high content of ether-extractables (about 19 per cent. of the dry weight). CaO, K_2O and P_2O_5 contents were highest in leaves of *V. myrtillus* and lowest on the whole in those of *Calluna*.

(iv) In spite of a low mineral-nutrient content, the *Calluna* type will add the greatest supply of such nutrients to the humus layer, owing to the sheer quantity of litter produced per unit area. Calculations are made to show the supply, per ha. and year, of materials to the humus layer, but it is stressed that in the types concerned decomposition is slow; furthermore, the amounts of minerals taken up by the plants far exceed those in the litter and are largely accumulated in lignified stems and roots which also decompose slowly.

(v) Yields of mineral nutrients to be expected from the burning of the aerial parts are calculated for each of the Ulvsjøberg types. For the *Calluna* type these amount to (kg./ha.) CaO 68·1, K_2O 55·9, P_2O_5 28·4, and for the *Myrtillus* type the corresponding figures are 43·1, 25·7, and 10·7. Burning of such vegetation may thus be expected to have the effects of a fairly good application of mineral fertilizers, and other presumed beneficial effects would be acceleration of N transformation in the humus, a green-manuring effect by the dead mycorrhizal roots, elimination of competition and of interception of precipitation.

(vi) Abundance of the species dealt with is usually an indication, in productive forest stands, of poor utilization of the productive capacity of the soil, and it is important to have as little as possible of such ground vegetation. Thin and overmature stands with dense suffruticose ground cover should be regenerated as soon as possible and the aim should be to have dense stands of young trees and to use short rotations.

44.2. *Parasitic Higher Plants*

[1403]. 44.2 : 12.25 : 12.26–8. LANTERNIER, M. Le gui sur sapin pectiné dans le département de la Savoie. **[Mistletoe on Silver Fir in the department of Savoy.]** *Rev. Eaux For.* 82 (8), 1944 (460–9). [F.]

Silver Fir [*Abies alba*] tends to replace Spruce in Savoy, but is subject to severe infestation by Mistletoe, which sometimes ends by completely killing the Fir. Spruce and Pine are rarely attacked, and Larch not at all. Even-aged stands are more vulnerable than selection forest, in which only the dominants are attacked. Infestation is most severe on permeable soils, in a dry climate and at low altitudes. The infestations are all on sites with a north-east aspect. The injuries caused to the host trees are slowing down or arrest of height and diameter increment, decrease in the proportion of sawtimber to total volume, in the quality of the wood, and in the production of cones.

44.3. *Fungi*

See also *For. Abstr.* 8 (Nos. 1373, 1379, 1381, 1445, 1459–60).

[1404]. 44.3 : 44.4. WILSON, E. E., and BAKER, G. A. **Some features of the spread of plant diseases by air-borne and insect-borne inoculum.** *Phytopathology* 36 (6), 1946 (418–32). [Univ. of California, Davis, Calif.]

Numerical data on the spread of plant diseases from centres of infection to the above-ground parts of nearby susceptible hosts were compiled from the literature, and the rate at which the incidence of infection diminished with increases in distance from the source of inoculum examined. The diseases were of three categories with respect to the mode of inoculum dissemination: (1) fungus diseases spread by means of air-borne spores; (2) a bacterial disease spread by means of wind-blown rain; (3) virus and fungus diseases spread by insect vectors.

The gradients of infection that develop in the vicinity of sources of inoculum were compared with the pattern which appears to characterize the aerial dissemination of spores. According to the results of earlier studies, for a distance of 15 ft. at least from the source, the density, or number of air-borne spores passing through unit areas of planes perpendicular to the direction of the wind, diminished in inverse proportion to the square of the distance from the source of inoculum, and the rate at which dispersion (the scattering of spores in dimensions perpendicular to the direction of the wind) increased was directly proportional to the distance from the source.

Data on the spread of angular leaf spot of cotton by wind-blown rain, yellows of endive by leafhoppers, yellow dwarf of potatoes by leafhoppers, and Dutch Elm disease by bark beetles suggest that in such cases, also, the relationship between incidence of infection and distance from the source is similar in some respects to that occurring in the spread of diseases by air-borne spores.

An equation, employed by Gregory for the transfer of atmospheric properties by eddy diffusion and representing the dispersion of air-borne particles downwind from a source, was examined. The major difficulty encountered in applying the eddy diffusion equation to disease gradient data arises from its failure to account for the combined effects of a large number of variables. *From authors' summary.*

[1405]. 44.3 : 45.3 : 12.11.21 : 44.4. WOLFENBARGER, D. O. **Dispersion of small organisms. Distance dispersion rates of bacteria, spores, seeds, pollen and insects: incidence rates of diseases and injuries.** *Amer. Midl. Nat.* 35 (1), 1946 (1–152).

A comprehensive paper on the horizontal and, to a less extent, vertical dispersion of small animate and inanimate bodies. In Part I data are given from literature to illustrate the dispersion and incidence rates of viruses, bacteria, fungal spores (including those of *Ceratostomella ulmi*, *Endothia parasitica*, *Gymnosporangium juniperi-virginianae*, *Cronartium ribicola* and *Polyporus schweinitzii*), pollen of flowering plants, seeds of gymnosperms (including *Abies alba*, *A. nobilis*, *Pseudotsuga taxifolia*, *Tsuga heterophylla*, *Picea mariana*, *Juniperus scopulorum*) and angiosperms (including *Juglans regia*), and various insects (including *Popillia japonica*, *Scolytus multistriatus*, *Dendroctonus valens*, *Hylurgopinus rufipes*, *Porthetria dispar*, and *Anastatus bifasciatus*).

Among the subjects treated in Part II ('Generalizations') are: dispersion distance, direction of dispersion, factors influencing dispersion, agencies or means of dispersion, the effect of density levels at the source, and the relationship between dispersion and control measures. There are 9 pages of references and a 5-page index.

[1406]. 44.3 : 12.21. **Honey fungus: *Armillaria mellea* Vahl. = *Agaricus melleus* L.** *Leafl. For. Comm., Lond.* No. 6 (revised), 1946. pp. 7.

[1407]. 44.3 : 12.21 : 11.41.1. BLISS, D. **The relation of soil temperature to the development of *Armillaria* root rot.** *Phytopathology* 36 (4), 1946 (302–18). [Univ. of California Citrus Exp. Sta., Riverside, Calif.]

This paper reports a series of 6 soil-temperature experiments with *Armillaria mellea* root rot on 9 economic and ornamental species of plants. Inoculated plants were grown for 181 to 438 days in the greenhouse in 5 soil-temperature tanks in which the water baths were held at controlled temperatures between 7° and 38° C. Air temperatures ranged between 21° and 27°. Pathogenesis in test plants was observed at soil temperatures ranging from 7° to 25° C. Greatest resistance was shown by all plants at temperatures most favourable to root growth.

There are two critical temperatures for *Armillaria* root rot in any suscept: one at each extremity of the range for pathogenesis. The lower temperature is of minor importance, usually lying below the minimum for root growth, but the upper is important, because many suscepts thrive at higher temperatures, at which they are free from attack. The disease may have slightly different critical temperatures in each species, but the upper critical temperature is tentatively placed at 26° C. in all cases. *From author's summary.*

[1408]. 44.3 : 12.21. RHOADS, A. S. **A comparative study of two closely-related root-rot fungi, *Clitocybe tabescens* and *Armillaria mellea*.** *Mycologia* 37 (6), 1945 (741–66). P.R.

The taxonomy of *Clitocybe tabescens* is discussed with reference to the assumption that it is merely an exannulate form of *Armillaria mellea*. The root rots caused by these closely related fungi have been found to agree with respect to the symptoms exhibited by attacked plants, but cultural studies have shown striking differences between the two fungi. It does not appear that the growth of either is sufficiently limited by the pH of the medium to offer any practicable application from the standpoint of control measures. *From author's summary.*

[1409]. 44.3 : 12.21. OVERHOLTS, L. O., and LOWE, J. L. **New species of *Poria*.** *Mycologia* 38 (2), 1946 (202–12). [Pennsylvania State College, Penn., and New York

State College of Forestry, Syracuse Univ., Syracuse, New York.] P.R.

Descriptions of *Poria alutacea, P. illudens, P. carbonica, P. mappa, P. rubens* and *P. fissiliformis* Pilat n.spp.

[1410]. 44.3 : 12.21. WHETZEL, H. H. **A synopsis of the genera and species of the Sclerotiniaceae, a family of stromatic inoperculate Discomycetes.** *Mycologia* 37 (6), 1945 (648–714). [Cornell Univ., Ithaca, N.Y.] P.R.

Provides a generic index of the host plants (including numerous trees) of the Sclerotiniaceae with the fungi parasitic upon them.

[1411]. 44.3 : 12.25 : 12.21. **Conifer heartrot (*Fomes annosus* (Fr.) Cooke = *Trametes radiciperda* Hartig).** *Leafl. For. Comm., Lond.* No. 5 (revised), 1946. pp. 7.

[1412]. 44.3 : 12.25 : 12.21 (43.9). GYÖRFI, J. A *Fomes annosus* Fries károsítása a soproni botanikus kertben. **[Damage by *Fomes annosus* in the Sopron Botanic Garden.]** *Erdész. Kisérl.* 45 (1/4), 1943–4 (71–86). [Hu.G.e.]

F. annosus was established as the cause of the death of Norway Spruce trees about 50 years old in the garden, the infected part of which had formerly been agricultural land. Symptoms of the attack on the trees and their wood are described by stages, and notes are included on secondary insect pests, chiefly bark beetles and cerambycids, which attacked the diseased trees.

[1413]. 44.3 : 12.25 : 12.21 (74). SPAULDING, P., and HANSBROUGH, J. R. **Decay in Balsam Fir in New England and New York.** *Tech. Bull. U.S. Dep. Agric.* No. 872, 1944. pp. 30.

In an investigation of decay and resultant cull of merchantable timber in Balsam Fir (*Abies balsamea*) from eastern Maine, northern New Hampshire, and the Adirondacks in New York, more than 1,100 trees 40 years of age and upward were dissected and the data analysed to show the relation of cull to age, diameter, site factors, and growth rates. Decay severe enough to cause cull affected half the trees at 72 years and all at 165. About one-fourth of the total volume of all trees was culled.

Most of the cull was due to three decays: top rot (54 per cent.) caused by *Stereum sanguinolentum*; brown butt rot (13 per cent.) caused by *Polyporus balsameus*; and white stringy butt rot (28 per cent.) caused by *Poria subacida*. The remainder was due to miscellaneous fungi and form defects. Both butt and top rots appeared at about 40 years.

On a volume basis, cull losses in the trees studied were almost identical on good and poor sites. On a percentage basis, however, the losses were higher on poor sites. Certain measures are recommended for the management of Balsam Fir for pulpwood. *From authors' summary.*

[1414]. 44.3 : 12.25 : 12.21. CASH, E. K. **Some new species of fungi on *Libocedrus*.** *Mycologia* 37 (3), 1945 (311–7). [U.S. Plant Industry Station, Beltsville, Maryland.] P.R.

Includes descriptions of two new genera (*Parksia* and *Camaropycnis*) and three new species (*P. libocedri, C. libocedri*, and *Tryblidiella macrospora*) growing on *Libocedrus decurrens* in California.

[1415]. 44.3 : 12.25 : 12.21 (71.1) : 52.46. BIER, J. E., and FOSTER, F. E. **The relation of research in forest pathology to the preparation of forest inventories. I. Suggested aids for cruising overmature stands of Sitka Spruce on the Queen Charlotte Islands.** *B.C. Lumberm.* 30 (4), 1946 (38–40, 64). [Dominion Laboratory of Forest Pathology, Victoria, B.C.]

The data presented in this paper are based on a detailed stem analysis of 1,977 trees of Sitka Spruce on the Queen Charlotte Islands, and are applicable only to Sitka Spruce in that region. Infections were not common in trees under 200 years of age. The percentage of diseased trees increased steadily in the later age classes, and at 700 years all the trees were infected at some point in their merchantable length. Of the 1,977 trees analysed, 47 per cent. had deductions for decay. Data on the average gross merchantable volumes, decay volumes and net merchantable volumes are given in graphic and tabular form.

The present data indicate that the losses from decay represent an important factor for consideration in the management of overmature stands on the Queen Charlotte Islands. The total loss from decay is the result of attack by 31 species of wood-destroying fungi. Most of this decay is not apparent on the outside of the tree and data must therefore be obtained from adequate samples of felled timber. Further investigations are being made on the degree of

decay in Western Hemlock in Queen Charlotte Islands and Balsam in British Columbia.

[1416]. 44.3 : 12.25 : 12.21 (71.1) : 31.8. BIER, J. E. **The relation of research in forest pathology to the utilization of overmature timber. The significance of brown pocket rot in Sitka Spruce on the Queen Charlotte Islands.** *B.C. Lumberm.* 30 (6), 1946 (54–5, 74).

In 1942 the attention of the Victoria laboratory was called to a decay in Sitka Spruce which was proving troublesome in Queen Charlotte Islands. The decay is a brown pocket rot which occurs in the heartwood of living Sitka Spruce. It may occur in any part of the tree but is most frequent as a butt rot confined to the first and second 40-ft. logs. Given sufficient moisture, the fungus may continue to develop in dead trees for long periods. It is common to find isolated pockets at some distance from the main body of decay and separated from it by what appears to be sound wood. For this reason, the amount of rot visible on the two ends of a log may not indicate the extent of internal decay. The causative fungus will be described by A. H. Smith as *Lentinus kauffmanii* sp. nov. Its distribution coincides with that of Sitka Spruce.

The gross merchantable volume of the 1,977 trees analysed amounted to nearly 14 million bd. ft., of which 11½ per cent. was destroyed by decay. Brown pocket rot resulted in a loss of 0·9 per cent. of the gross merchantable volume and was the fourth most important decay, following (in order of importance) *Fomes pini*, *Polyporus schweinitzii* and *Fomes pinicola*. It was, moreover, responsible for the loss of 1·6 per cent. of the volume of Grade I logs, which are cut from the basal region of trees and which have the greatest value for recovery of clear lumber, and was second in importance only to *P. schweinitzii* in logs of this grade. The study failed to demonstrate a relationship between age of the tree and incidence of brown pocket rot. So far, no reliable external indication is known which would indicate the presence of this decay in standing trees. Analyses of trees with basal infections demonstrated that when a large area of rot occurred on the stump end of the basal 40-ft. log, the decay extended into the second log. Infections with a small number of isolated pockets at the base usually ran out before the top end of the first log.

[1417]. 44.3 : 12.25 : 12.21 (71.1) : 31.8. BIER, J. E., and FOSTER, R. E. **The relation of research in forest pathology to the utilization of overmature timber. II. Significance of conk rot in Sitka Spruce on Queen Charlotte Islands.** *B.C. Lumberm.* 30 (5), 1946 (51–2, 65).

Stem analyses of Sitka Spruce on the Queen Charlotte Islands demonstrated that 'conk rot' (*Fomes pini*) was the most important decay in terms of total volume of wood destroyed, being responsible for 40 per cent. of the total loss through rot in the 1,977 trees examined. On the basis of grade, however, it was evident that a large part of the decay occurred in the tops of the trees which would yield logs of the poorer grades for reasons other than the presence of decay. Analysis of data from the 354 infected trees showed that an average of 97·8 of the Grade 1 and 89·2 per cent. of the Grade 2 logs in trees infected by conk rot are free from this decay. A majority of this decay occurs in the Grade 3 logs, only 55·4 of this material being free from rot. The 'conks' or fruiting bodies of the fungus serve as a reliable external indication of this type of decay in Sitka Spruce. Although the decay may be extensive in the tops of the trees, it usually does not extend for any appreciable distance below the lowest fruiting body which is present on an infected tree. Diseased trees with long rows of fruiting bodies extending down to a distance of 50 or 60 ft. above ground should be felled, since it is probable that a high percentage of the Grade 1 or Grade 2 wood in the basal log will be free from decay.

[1418]. 44.3 : 12.25 : 12.21. GRUENHAGEN, R. H., RIKER, A. J., and RICHARDS, C. A. **Burn-blight of Jack and Red Pine following spittle insect injury.** *Abstr.* in *Phytopathology* 36 (5), 1946 (399). [Wisconsin Conservation Dept., and Wisconsin Agricultural Exp. Sta.]

A serious disease, first brought to attention in 1941, has been killing Jack and Red Pine progressively from top to bottom. In northeastern Wisconsin the damage now extends over 6,000 acres on 64 areas in 9 counties. Evidence, which included completing Koch's postulates with 6 single-spore isolates, showed *Chilonectria cucurbitula* (Curr.) Sacc. to be the causal agent. The disease usually followed injury by the Saratoga spittle insect (*Aphrophora saratogensis*), which carried the fungus and

introduced it while making numerous feeding punctures in the twigs. This insect was active from early July through September and the fungus usually appeared to incubate over autumn and winter and induced most rapid necrosis from April to mid-July following. Although the fungus usually entered through feeding punctures, it was found developing from wounds caused by other agencies. Jack Pine on a poor site, over a 14-month period, had over 100 times more disease than comparable trees on a good site. Severe top and branch pruning did not increase the incidence of disease on Jack Pine. The most promising immediate preventive seems to be control of the insect vector.

[1419]. 44.3 : 12.25 : 12.21 (79.4 : 79.5). BENEDICT, W. V., and HARRIS, T. H. **White Pine blister rust control in California and Oregon.** U.S. Bureau of Entomology and Plant Quarantine. 1945. pp. 12 + plates + maps.

California and Oregon have within their borders the whole range of the commercially important Sugar Pine, 2,500,000 acres of which have been included by the Federal Government in the blister-rust control area. At the end of the 1944 season, initial *Ribes* eradication in California and Oregon was 37 per cent. completed, and the total control job, including such successive reworkings as are necessary, was 22 per cent. completed. Prompt protection of the susceptible Sugar Pine stands is necessary if excessive losses are to be avoided. *From authors' summary.*

[1420]. 44.3 : 12.25 : 12.21. **Two leaf-cast diseases of Douglas Fir.** *Leafl. For. Comm., Lond.* No. 18 (revised), 1946. pp. 6.

Notes on needle-cast of Douglas Fir in Great Britain caused by *Rhabdocline pseudotsugae* and *Phaeocryptopus gaeumanni* respectively. No proved control measures are known.

[1421]. 44.3 : 12.25 : 12.21. ELLIS, D. E., and GILL, L. S. **A new *Rhabdogloeum* associated with *Rhabdocline pseudotsugae* in the Southwest.** *Mycologia* 37 (3), 1945 (326–32). P.R.

The conidial form found associated with *Rhabdocline* on *Pseudotsuga taxifolia* needles in Arizona and New Mexico is described as *Rhabdogloeum hypophyllum* n. sp. It is possibly a stage in the life history of *Rhabdocline pseudotsugae.*

[1422]. 44.3 : 12.26–8 : 12.21 (71.4). POMERLEAU, R. **Occurrence and importance of cankers and rots in deciduous forests in Quebec.** *Abstr.* in *Phytopathology* 36 (5), 1946 (408).

Surveys in several localities in Quebec were made between 1942 and 1944 to obtain information on the health of deciduous forest trees. At the Forest Experimental Station at Duchesnay, 3,147 trees distributed in 115 sample plots were studied. The data obtained were completed by surveys in Sugar Maple groves in 17 localities, and by stem analysis of 279 trees in 4 sample plots in a White Birch stand. At Duchesnay, 13·9 per cent. of the trees were infected with at least one canker, and 21 per cent. were more or less severely rotted. Close examination of 930 trees in Maple groves showed that 22·1 per cent. of them were cankered and 18·4 per cent. rotted. In the White Birch stand, 9·5 per cent. of 279 trees were cankered and 14·3 per cent. rotted. In all these stations, *Nectria* canker was the most prevalent and injurious, especially to Maple, White Birch, and Yellow Birch, and the incidence of infection varied with site. *Eutypella* canker occurred on 3 to 8 per cent. of the Maples, especially on the young trees. *Diatrype macounii*, *Poria punctata*, and *Pholiota squarrosoides* were found for the first time to be responsible for canker. *Fomes igniarius* caused the most widespread rot in Maple, Birch, and Aspen, but other fungi, taken together, produced comparable losses.

[1423]. 44.3 : 12.26–8 : 12.21. CRANDALL, B. S. **A new species of *Cephalosporium* causing Persimmon wilt.** *Mycologia* 37 (4), 1945 (495–8). P.R.

Cephalosporium diospyri, n. sp., causes a wilt disease found on the American Persimmon, *Diospyros virginiana.* Certain other species of *Diospyros* were proved susceptible by inoculation.

[1424]. 44.3 : 12.26–8 : 12.21. STEVENSON, J. A., and IMLE, E. P. ***Periconia* blight of *Hevea.*** *Mycologia* 37 (5), 1945 (576–81). [Bureau of Plant Industry Sta., Beltsville, Md., and U.S.D.A. Rubber Sta., Turrialba, Costa Rica.] P.R.

Periconia heveae n. sp. is found on living leaflets, petioles, and smaller twigs of *Hevea spruceana* and, to a lesser degree, of *H. brasiliensis* in Costa Rica. The disease, although very

destructive during the wet season to *H. spruceana*, is not expected to become a problem in *H. brasiliensis* plantations, except where both species are grown in mixture.

[1425]. 44.3 : 12.26–8 : 12.21. LANGFORD, M. H. **South American leaf blight of *Hevea* rubbertrees.** *Tech. Bull. U.S. Dep. Agric.* No. 882, 1945. pp. 31.

Despite the numerous factors favouring a rubber-growing industry in tropical America, most early attempts to cultivate the Para Rubber tree (*Hevea brasiliensis*) there ended in failure. These failures were due primarily to a single unfavourable biological factor—devastating attacks of South American leaf blight, caused by the fungus *Dothidella ulei*. The present bulletin reports the result of a 4-year study of the influence of environmental factors on leaf-blight severity and gives the results of a series of resistance tests on *Hevea* plant material assembled from many parts of the world. A technique for testing *Hevea* clones for resistance to leaf blight is described, and a system of classifying them for resistance or susceptibility is presented and illustrated.

[1426]. 44.3 : 12.26–8 : 12.11.3. BLAKE, M. A., and EDGERTON, L. J. **Experiences with blight-resistant Chestnuts in New Jersey.** *Bull. N.J. agric. Exp. Sta.* No. 717, 1945. pp. 20.

Notes on experiments with *Castanea mollissima*, *C. crenata* and *C. sativa* in New Jersey, where the native species *C. dentata* has been almost exterminated by Chestnut blight. *C. mollissima*, though not immune, has a fair degree of resistance, particularly if the young tree is prevented from developing main branches near the ground and trained in an upright form, which greatly lessens the danger of blight cankers developing on the trunk.

[1427]. 44.3 : 12.26–8 : 12.21. DIETZ, S. M., and BARRETT, J. W. **Spread and control of Oak wilt.** *Abstr.* in *Phytopathology* 36 (5), 1946 (397).

Oak wilt has been found in Illinois, Iowa, Minnesota, Missouri, and Wisconsin. This disease, caused by *Chalara quercina* Henry and first recorded in Iowa in 1932, occurred throughout the State in 1944 and 1945, being most severe in the eastern part. It has been epiphytotic on *Quercus alba*, *Q. borealis maxima*, *Q. ellipsoidalis*, *Q. imbricaria*, *Q. macrocarpa*, and *Q. velutina*. Using Koch's postulates, the 13 species of Oaks recorded as native to Iowa have been proved to be hosts for *Chalara quercina*. The rate of spread, which occurred in concentric zones from the initial point of infection, varied with the season and the species of Oak. Initial infection is in the crown of the tree and the fungus progressively infects leaves, stem, and roots. The fungus spreads more rapidly in Red Oak trees than in White or Burr Oak. The symptoms varied with the species of Oak. The fungus rarely overwinters on Red Oaks, usually on White and Burr Oak. It has been isolated repeatedly from dead twigs 6 months after infected trees were felled. For 2 years various sanitation methods have checked and sometimes controlled the spread of Oak wilt.

[1428]. 44.3 : 12.26–8 : 12.21. FOËX, E. L'invasion des chênes de l'Europe par le blanc ou oïdium (*Microsphaera Alphitoïdes* Griffon et Maublanc). [**The infestation of Oaks in Europe by white mildew (*Microsphaera alphitoides*).**] *Rev. Eaux For.* 79 (5), 1941 (338–49). [F.]

A brief historical account of Oak mildew, followed by a description of the disease, life history of the parasite, host species, taxonomy, and development of the disease since its first appearance in France in 1907. The writer would include all the species of *Microsphaera* known to occur on Oak in one species, *M. quercina* (Schw.) Burr.

[1429]. 44.3 : 12.26–8 : 12.21. BRAMBLE, W. C. ***Strumella* canker in a northern Red Oak plantation.** *J. For.* 44 (7), 1946 (527). [Pennsylvania State College.]

Red Oak (*Quercus borealis*) is particularly susceptible to *Strumella* canker. An example is given of a mixed plantation of young Pine and Red Oak in which 63 per cent. of the Oaks were dead or cankered. The nearest source of infection was a natural Oak/Pine stand from which a number of trees bearing *Strumella* cankers had been taken out in an improvement cutting when the Oak plantation was 6 years old, too late to prevent serious infection. It is recommended that establishment of Red Oak plantations adjacent to infected Oak stands should be preceded by careful removal of diseased trees.

[1430]. 44.3 : 12.26–8 : 12.21. WALTER, J. M. **Canker stain of Planetrees.** *Circ.*

U.S. Dep. Agric. No. 742, 1946. pp. 12 [U.S. Bureau of Plant Industry.]

Canker stain of Plane trees (chiefly *Platanus acerifolia*) in the eastern United States is due to an *Endoconidiophora* sp. which infects through damaged bark, and even in areas where the disease is most active, only pruned or mutilated trees have been attacked. Dissemination of the pathogen is brought about largely during pruning operations, and sanitation measures, including the disinfection of pruning tools, are essential in any attempt at disease control.

[1431]. 44.3 : 12.26–8 (45). CITERRI, R. Malattie del pioppo. [**Diseases of Poplar.**] *Bosco* Sept., 1944 (2). [It.] X.

[1432]. 44.3 : 12.26–8 : 12.21. SEAVER, F. J. ***Sclerotinia bifrons.*** *Mycologia* 37 (6), 1945 (641–7). [The New York Botanical Garden, Bronx, New York City.] P.R.

Sclerotinia confundens Whetzel (1940) is a synonym of *bifrons* Seaver and Shope (1930), being the ascigerous stage on *Populus tremuloides* in Colorado. The variety found on *P. tremuloides* in the Rocky Mountains differs from the eastern form in its perfect stage.

[1433]. 44.3 : 12.26–8 : 12.21 : 44.4. CHESTER, K. S. **Elm diseases in Oklahoma.** *Mimeo. Circ. Okla. agric. Exp. Sta.* No. M–144, 1945. pp. 3.

[1434]. 44.3 : 12.26–8 : 12.21. CARTER, J. C. ***Tubercularia*** **canker and dieback of** ***Ulmus pumila*** **L.** *Abstr.* in *Phytopathology* 36 (5), 1946 (395).

In August, 1939, branch and trunk cankers were observed in several trees 4 to 10 ft. high in a commercial nursery planting of Siberian Elm (*Ulmus pumila*). Single-spore isolations were made from black sporodochia that had developed in the cankerous bark. The fungus isolated was a species of *Tubercularia*, apparently undescribed. Seven trunk and 18 branch inoculations were made on 21 Siberian Elms on 6th April, 1940. Infection developed from 6 of the trunk inoculations and 17 of the branch inoculations, and subsequently cankers were produced. In general, infection became evident within 10 days and sporodochia became visible in about 20 days. Cankers on trunks and branches continued to enlarge until mid-June, at which time callus tissues began to develop at their margins. By late August many of the cankers were covered with callus. Cankers produced by both inoculations and natural infections failed to enlarge in succeeding years. Branches which had been inoculated died gradually downward from the point of inoculation, usually to distances of 4 to 8 in. by mid-June.

[1435]. 44.3 : 23.26 : 42. BEACH, W. S. **Pathogenic and physiogenic damping-off.** *Soil Sci.* 61 (1), 1946 (37–46). [Pennsylvania Agricultural Exp. Sta.] O.R.E.

Physiogenic diseases with symptoms very similar to those caused by pathogenic damping-off may be due to high temperature accompanied by excessive drying of the soil, and by too great concentration of the soil solutes. Pathogenic damping-off is caused by a variety of parasitic, soil-inhabiting fungi, of which *Pythium* spp., *Corticium vagum* and *Fusarium* spp. are probably the most important. Forest tree seedlings (particularly conifers) are very liable to attack by these fungi owing to the inherently slow germination of the seed; and cuttings are also very susceptible. The most important damping-off fungi are not solely parasitic but can also live on dead plant materials, including humus.

The author discusses the effect of temperature, light, moisture, soil acidity, humus and high concentrations of solutes on relative abundance, survival and growth of the damping-off fungi. Control may be effected by the pre-treatment of seed with a fungicidal dust, preferably augmented by sterilizing or fungicidal treatment of the soil.

44.4. *Virus Diseases*

[1436]. 44.4. **Common names of virus diseases used in the Review of Applied Mycology.** *Rev. appl. Mycol.* 24 (13), 1946 (513–56).

[1437]. 44.4 : 12.26–8 (78). BEILMANN, A. P. **Phloem necrosis—a serious threat to the Elm.** *Bull. Mo. bot. Gdn.* 33 (6), 1945 (128–130). L.S.

45. DAMAGE BY ANIMALS

45.1. *Mammals*

[1438]. 45.1 (54.87). CEYLON. **Silvicultural research: Ceylon: 1944.** Office of the Conservator of Forests, Colombo, Ceylon. 1946. pp. 16.

The highland giant squirrel, *Ratufa macroura macroura*, caused serious damage in Cypress plantations by crown-girdling. The stomach contents of a freshly killed animal revealed shreds of the soft inner bark of Cypress still undigested (p. 15).

[1439]. 45.12 : 12.25 : 13.2 : 13.15. LUNDBERG, G. Ekorrskador på granplanteringar. **[Squirrel damage to Norway Spruce plantations.]** *Skogen* 33 (13), 1946 (204–5). [Sw.]

Squirrel populations in Sweden show a marked periodicity which is closely correlated with the occurrence of general seed years in Norway Spruce. Extra winter food is first afforded by the flower buds, and after one such favourable winter earlier breeding and larger litters occur in the spring. During the next winter, when the cones are ripe, the squirrels live in plenty, and if, as often happens, a good Pine seed year should follow, mass reproduction may be achieved. It is after such a peak that squirrel damage is most extensive, especially if Spruce flower buds are rare in the fourth winter. Beside the usual damage by top-girdling of various species [cf. *For. Abstr.* 7 (No. 1416); 8 (No. 694)], Lundberg has observed in the winter 1945–46 a new form of damage to Spruce, consisting in the biting off of leaders on strong top and upper side shoots a few cm. below the shoot apex. The whorl of buds is eaten and the shoot tip is then discarded. Both young plants and trees up to 15 m. high had been so attacked. Over considerable areas the tips of vigorous shoots, especially leaders, had been removed from practically all the trees.

[1440]. 45.12 : 12.25–8 : 13.2. SWEETMAN, H. L. **A supplementary note on the winter food habits of cottontail rabbits.** *Ecology* 27 (2), 1946 (185–8). [Massachusetts State College, Amherst, Mass.]

Additional information on the selection of woody plants as food by the cottontail rabbit, *Sylvilagus floridanus mallurus*. [Cf. *For. Abstr.* 6 (259).]

[1441]. 45.12 : 12.25–8 : 13.2. HILL, R. H. **Palatability ratings of Black Hills plants for white-tailed deer.** *J. Wildlife Mgmt.* 10 (1), 1946 (47–54). B.A.P.

Two tables give (1) food available and eaten by deer (*Odocoileus virginianus macrourus*) in the Black Hills (western South Dakota and north-eastern Wyoming) in 1941–42; and (2) palatability groupings by 3-month periods of deer forage in the Black Hills. Seasonal preferences varied greatly. A high degree of palatability at particular seasons was shown by Red Willow, Willow, Sumac, Ponderosa Pine and Aspen. The same species frequently proved unpalatable at other times of year.

[1442]. 45.12 : 12.26–8 : 13.2. COOK, D. B. **Summer browsing by deer on cut-over hardwood lands.** *J. Wildlife Mgmt.* 10 (1), 1946 (60–3). B.A.P.

On recently clear-cut hardwood forest land in Rensselaer County, New York, white-tailed deer [*Odocoileus virginianus*] have exhibited marked selectivity in summer feeding. New sprouts of Grey Birch [*Betula populifolia*], Hard Maple [*Acer saccharum*], and White Ash [*Fraxinus americana*] and of several less abundant species were much eaten, while other trees and shrubs were lightly used or completely ignored. Seedlings were definitely less attractive than new sprouts of the same species. Where such cut-over land is being converted by planting conifers, deer browsing may be of some assistance in keeping down the hardwood sprouts. Where regeneration is being sought by any method involving substantial opening of the forest canopy, hardwood reproduction will usually be so abundant that deer damage will be of little consequence. *Author's summary.*

45.2. *Birds*

[1443]. 45.2 : 12.26–8 : 13.2 (74.1). BROWN, C. P. **Food of Maine ruffed grouse by seasons and cover types.** *J. Wildlife Mgmt.* 10 (1), 1946 (17–28). B.A.P.

Of the food of the ruffed grouse (*Bonasa umbellus togata*) in Maine, Aspen formed the main single item, Aspen buds being of first importance in winter and spring.

[1444]. 45.2 : 12.26–8 : 13.2 (77.1). GILFILLAN, M. C., and BEZDEK, H. **Winter foods of the ruffed grouse in Ohio.** *J. Wildlife Mgmt.* 8 (3), 1944 (208–10). B.A.P.

The fruit and leaves of Greenbrier (*Smilax* sp.) and the buds of *Populus grandidentata* and *P. tremuloides* comprised 15·3 and 14 per cent. respectively of the total winter foods of the ruffed grouse (*Bonasa umbellus*) in the Beech/Maple and Oak/Hickory forests of Ohio.

45.3. *Insects*

See also *For. Abstr.* 8 (Nos. 978–83).

[1445]. 45.3 (41.5) : 44.3. QUIRKE, D. A. **Forest pathology: its significance in relation to Irish forestry practice.** *Irish For.* 3 (1), 1946 (10–25).

This article is based on data collected during a survey of Irish woodlands in respect of insect and fungus pests carried out by the writer during the years 1942–45. The most serious insect pests are *Rhyacionia buoliana*, *Prays curtisellus*, *Hylobius abietis*, *Adelges* spp. and *Chionaspis salicis*. The most serious fungus pests are *Armillaria mellea*, *Fomes annosus*, *Dasyscypha calycina*, and *Nectria ditissima*. Notes are given on these and some other insects and fungi.

[1446]. 45.3 (497.1). GRADOJEVIĆ, M. Allgemeine Übersicht über die Entwicklung der forstlichen Entomologie in Jugoslawien. **[General review of the development of forest entomology in Jugoslavia.]** *Intersylva* 1, 1940–1 (26–32). [G.e.f.it.span.]

[1447]. 45.3 : 12.25–8 : 13.2. THIEM, H. Über die bisherige Leistung der Maikäferbekämpfung mit staubförmigem Dinitro-orthokresol **[On the results to date of cockchafer control with dinitro-ortho-cresol in dust form.]** *Forstwiss. Cbl.* 62 (3), 1940 (49–55). [G.]

[1448]. 45.3 : 12.25–8 : 13.2. **Chafer beetles.** *Leafl. For. Comm., Lond.* No. 17 (revised), 1946. pp. 11.

The leaflet deals briefly with the distribution and life history of *Melolontha melolontha*, *Amphimallus solstitialis*, *Serica brunnea*, *Phyllopertha horticola*, and *Anomala aenea*, the nature of the damage they cause in nurseries, and methods of control. These include (1) regular rotation of the nursery ground, leaving about 30 per cent. either fallowed or under a green crop each season; (2) adequate summer cultivation of the unstocked ground; (3) hand-picking of all larvae exposed by summer cultivation; and (4) encouragement of the natural enemies of the beetles such as insectivorous birds.

[1449]. 45.3 : 12.25–8 : 13.2 (43.9). HARACSI, L. Pajorvizsgálatok a debreceni erdökben. **[Cockchafer investigations in the forests of Debrecen.]** *Erdész. Kisérl.* 45 (1/4), 1943–4 (127–60). [Hu.g.]

The natural woodland of the area is Pedunculate Oak with other hardwoods, but much has been cleared for plantations of *Robinia*, and later, Black Poplars. The sandy soil and the coppice forests, open in places and interrupted by non-forested areas, are highly favourable to cockchafers, of which *Melolontha vulgaris* is by far the commonest in the area. Data are given on larva frequency under different types of stand, the heaviest populations occurring in young Poplar, open old Oak, ploughed and afforested pasture, and young mixtures of Oak and Poplar, and the lightest on bare, cultivated land or where there is heavy shade. The adult chafers feed mostly on Oak, Norway Maple, and more rarely on Poplars: the larvae prefer Ash, Norway Maple, and Poplar to other species. Oak and Ash are very susceptible to larval attack, whereas Poplars, though extensively eaten, suffer little. Oak is raised locally by sowing under Poplar, and though the shade may not be heavy enough to keep larval populations low, the Poplar takes the brunt of the attacks.

Haracsi recommends the following precautionary measures: (i) Dense stands with an admixture of shadebearers, e.g. for this region *Tilia tomentosa* and *Acer platanoides*. (ii) Very cautious opening of young stands or nurse crops, openings to extend E–W and the direction of cutting to be N–S. Artificial regeneration to take place, so far as possible, only in main flight years, using strong 2- to 4-year plants. (iii) Conversion to high forest with small clear fellings. (iv) Reduction of area of ploughland and pasture within the forest. (v) Trap plots, to be left on or near planting sites, consisting of 15- to 25-year Oak and Norway Maple, 2- to 4-year Poplar cuttings or the like; these plots to be undisturbed in the main flight and the succeeding year. Planting sites to be cultivated and rolled so as to lie bare in the flight period; the main crop (e.g. Oak, Pine) to be planted, in autumn of the flight year or in the following spring, in mixture with Poplar cuttings. (vi) Protection of natural enemies of chafers, e.g. birds and bats, and provision of nesting boxes for them.

For direct control: (i) Systematic hand picking on trap plots and from roadside trees of Oak, Maple and Horse Chestnut, kept low for this purpose. (ii) Intensive cultivation of soil in fields, fallows and planting sites, and of young plantations, where possible without damage to

the trees. Trap sites to be cultivated in autumn of the flight year and repeatedly during the next summer, but not in the year preceding a flight year. (iii) Nurseries to be away from Oak woods if possible. Sowings to be made in the year following a flight year and transplants put out on fallows well cultivated during that year. Cultivation to be thorough and attractive plants such as small well rooted Poplar, carrots or lettuce to be mixed in the rows. Temporary nurseries on sites that bore closed forest during a flight year should also give good service.

[1450]. 45.3 : 12.25 : 13.2. BRIMBLECOMBE, A. R. **The biology, economic importance and control of the Pine bark weevil, *Aesiotes notabilis*.** *Bull. Qd. For. Serv.* No. 14, 1945. pp. 88. *Repr.* from *Qd. J. agric. Sci.* 2 (1), 1945.

Hoop Pine (*Araucaria cunninghamii*) plantations in Queensland are managed for the production of high-grade, knot-free timber. Early pruning of green and dead branches from the lower part of the commercial bole is the general practice. Occlusion following green pruning is quicker and causes less distortion to the grain of the later formed wood than does dead pruning, but the fresh wounds are attacked by borers. The endemic weevil, *Aesiotes notabilis*, derived from species of *Araucaria* and *Agathis* in Australian rain forests, is now common in Hoop Pine plantations and is beginning to be active in thinned plantations of exotic species of *Pinus*.

The larva tunnels round the base of a pruning stub, retarding occlusion and spoiling the timber; heavy attacks may kill the tree. A thorough investigation has been made of the life history of the weevil, which is recorded in detail in this bulletin. The life cycle takes about 3 months in the summer and 5 to 7 months over winter, but the beetles may live and lay eggs for more than 18 months and consequently infestation is possible throughout the year. Oviposition and the survival of early-stage larvae are highest at the highest atmospheric humidities.

Protection of pruned stubs by painting with oils or water-soluble preservatives is not satisfactory. It is recommended that pruning and thinning should be done when dry weather prevails, i.e. in winter and early spring. Operations at this season are not followed by economic damage by *Aesiotes*, owing to the solidification of gum exudations on the stubs. Thinned material can be used as traps to attract and hold the beetles if the thinning is done a week or so before pruning.

[1451]. 45.3 : 12.25 : 13.2. ***Adelges cooleyi*: an insect pest of Douglas Fir and Sitka Spruce.** *Leafl. For. Comm., Lond.* No. 2 (revised), 1945. pp. 4.

A brief description of signs of attack and injuries caused by *Adelges cooleyi* to Douglas Fir and Sitka Spruce in Great Britain, some natural enemies of the pest, and remedial and control measures. The most important natural enemies are *Aphidecta obliterata* and *Exochomus quadripustulatus*. Artificial control in established plantations is not practicable, but under certain conditions, spraying can be carried out in nurseries, gardens, and young plantations. Formulae are given for one paraffin and one nicotine spray.

[1452]. 45.3 : 12.25 : 13.2. GREAT BRITAIN. **Twenty-first annual report of the Imperial Forestry Institute: academic year, 1944–45.** University of Oxford. 1946. pp. 16.

Studies were made of the overwintering population (*sistens* stage) of the *Adelges* on Douglas Fir, to ascertain the density of distribution, and the counts showed that the *sistens* on the leaders and first whorls were fewer than on the branches lower down the tree, especially on their inner portions. This concentration of the *sistens* on the lower parts of the tree determines the location of the greatest number of predators which feed on the egg masses concentrated there (p. 11).

[1453]. 45.3 : 12.25 : 13.2 (931). RANGER, F. J. **Cicada damage to exotic shade bearers.** *N.Z. J. For.* 5 (2), 1945 (153).

Damage by cicada (*Melampsalta cingulata*) is so severe on several of the shade-bearing exotics used for interplanting logged indigenous forest on Waimiha State Forest, as to make their further use for this purpose questionable. The species most affected are *Thuja plicata*, *Cupressus macrocarpa*, and *C. lawsoniana*. *Cryptomeria japonica* is not affected. The leading shoot is damaged more often than the laterals, by the oviposition scars of typical chevron pattern. Breakage occurs at this point after the following season's growth. Exposed trees seem to be attacked more

frequently than those sheltered by secondary growth. Tawa [*Beilschmiedia tawa*] forest is a favourite haunt of the cicada.

[1454]. 45.3 : 12.25 : 13.2 (44). FEYTAUD, J. Les scolytides (*vulgo* bostryches) dans la forêt landaise. **[The Scolytidae (bark beetles) in the forests of the Landes.]** *Rev. Eaux For.* 84 (7), 1946 (373-407). [F.]

The author conforms to common French forestry usage and employs the term 'Bostryches' to mean bark beetles. The great forest fires of 1942, 1943 and 1945 have been followed in the northern part of the Landes by a severe infestation of *Pinus pinaster* by bark beetles, particularly *Ips sexdentatus*. The writer reports on surveys of the affected areas made in 1945 and 1946. Some apparently healthy trees, as well as fallen, burned or diseased ones, are attacked. Besides *Ips sexdentatus*, other bark beetles such as *Ips erosus*, *Pityogenes bidentatus*, *Crypturgus pusillus*, and *Xyleborus eurygraphus*, and other coleoptera such as *Pissodes notatus*, *Rhyncolus porcatus*, *Melanophila acuminata* and *Monochamus galloprovincialis* were observed. Amongst the factors encouraging the present infestation are the fires mentioned above, the existence of extensive pure stands of Pine, prolonged drought, and carelessness during logging and thinning operations in leaving logs in their bark lying in the woods.

[1455]. 45.3 : 12.25 : 13.2. GOURLAY, E. S. ***Erechthias fulguritella* Walk. (Lepidoptera) inhabiting Pine cones.** *N.Z. J. Sci. Technol.* 27B (3), 1945 (248–50). P.R.

Associated with cones of *Pinus radiata*, a native moth, *Erechthias fulguritella*, is recorded from Nelson Province, New Zealand. Its larvae invariably destroy the seed in infested cones, but have a negligible effect at present on seed production. *Author's summary.*

[1456]. 45.3 : 12.26–8 : 13.2. HEQVIST, K.-J. Bålgetingen (*Vespa crabro* L.) som skadegörare. **[The hornet, *Vespa crabro* L., as a pest.]** *Svenska SkogsvFören. Tidskr.* 44 (3), 1946 (260–7). [Sw.]

In a 9-year-old Birch plantation at Sjöarp, Blekinge (S. Sweden), 92 per cent. of the plants were found in 1945 to have been damaged by *V. crabro*, 60 per cent. of these having a dead top replaced by a second top developed from a lateral branch, and 10 per cent. having no living top. The stand was about 50 m. from the hornets' nest, which was in an old, hollow Ash. The damage consisted in bark stripping, the fragments of bark removed being dropped on the ground and the hornets feeding directly on the exuding sap. Wounds were of different types: some extended round the stem or branch as rings up to 20 mm. broad; some occurred as small patches here and there; but most were elongated strips (up to 12–15 cm. long in a few instances) running longitudinally. Attacks were commonest on the middle portion of branches, which appeared to be preferred to stems. The apices of ringed stems or branches on which the sapwood was wholly exposed were usually dead, death only occurring in the summer after that of the attack. The only effective means of preventing attack is to isolate and destroy the nest, either by burning or by fumigation with sulphur or the like, which is best done at night when the insects are inactive and reluctant to fly.

A review is made of Swedish and other literature on the life history of the hornet, including a table indicating tree species reported as attacked, the species most commonly attacked in each case, and, where reported, the time of and the reason (nest-building material or sap feeding) for the attacks. The species most commonly preferred appears to be Ash, followed by Alder and Birch.

[1457]. 45.3 : 12.26–8 : 13.2. PYENSON, L. **Eradication of Boxwood leafminer and the Boxwood psyllid.** *J. econ. Ent.* 39 (2), 1946 (264). [State Institute of Agriculture, Farmingdale, L.I.]

DDT, as a wettable spray powder diluted at the rate of 2 lb. of DDT per 100 gal. of water plus a sticker spreader, or as a 20-per-cent. solution in a miscible summer oil diluted 1 to 100 with water, gives excellent control of the Boxwood leaf miner [*Monarthropalpus buxi*] with one application applied when the pupal heads have darkened prior to adult emergence. A 1 to 100 nicotine-sulphate spray with spreader and wetter applied about the second week in June against the adult Boxwood psyllid [*Psylla buxi*] results in almost complete freedom from this pest in the following spring. *From author's summary.*

[1458]. 45.3 : 12.26–8 : 13.2 : 31.43 : 33.36.1. WHITTEN, R. R. **Preliminary experiments**

with DDT in 1944 for the control of the smaller European Elm bark beetle. U.S. Bureau of Entomology and Plant Quarantine. 1945. pp. 12. P.R.

Solutions, suspensions, and emulsions containing DDT were sprayed on cut Elm wood and living Elm trees to study their effect on the breeding and crotch-feeding activities of the smaller European Elm bark beetle (*Scolytus multistriatus*).

Non-infested, freshly cut Elm wood sprayed with DDT dissolved in kerosene at 2·5 to 50 grams per litre remained free from attack for the duration of the experiment, or 160 days. Emulsions containing DDT at 5 grams per litre of spray were effective in preventing attacks for 69 days. Cut Elm wood infested with the larvae of this bark beetle was sprayed with solutions of DDT in kerosene at 2·5 to 10 grams per litre. All the larvae were killed. An emulsion containing 5 grams of DDT per litre did not kill all the larvae, but the emerging adults were killed by the residual DDT on the bark surface. Sprays consisting of a solution of DDT in kerosene at 20 grams per litre when applied to living Elm trees prevented crotch feeding by adults of this species for more than 73 days. Emulsions containing DDT at a concentration equivalent to 20 grams per litre when sprayed on living Elm trees prevented the adult bark beetles from crotch feeding for 127 days. *Author's summary.*

47. COLLECTIVE INJURIES TO INDIVIDUAL TREE SPECIES

[1459]. 47 : 12.26–8 (71.6) : 44.3 : 45.3 : 07.7. NOVA SCOTIA. **Report of the Department of Lands and Forests, 1945.** King's Printer, Halifax. 1946. pp. 118.

Die-back of Birch continues to increase in the province. A considerable number of trees showing initial die-back have been peeled during the past two years to determine the amount of *Agrilus anxius* present. Borers were not found in trees with weakened foliage, and quite often trees with dead twigs as well as weakened foliage contained no galleries. It is considered at this stage that other factors are responsible for the start of this die-back and that *A. anxius* is merely a contributory factor to the eventual killing of the tree. [Cf. *For. Abstr.* 6 (49), 7 (No. 1426).] During 1944 and 1945 a number of fungi were isolated from material taken from dying and weak trees, and a series of inoculations were carried out with potted Birch seedlings. The following organisms have been found: *Gelatinosporium fulvum*, *G. betulinum*, *G. magnum*, *Phomopsis* sp., *Cryptosporiopsis* spp. Seedling inoculations to date indicate that a healthy Yellow Birch seedling with strong, uninjured root system, and well watered, will overcome inoculation of conidia from these organisms.

In the autumn of 1945 a start was made at determining whether some condition below the ground might be associated with Birch decadence. The primary intentions of the project were to develop a technique for exposing the tree roots and to determine whether similar examinations on a more intensive scale in different hardwood types and conditions would be warranted. Trees were chosen which showed various degrees of decadence; all were codominant Yellow Birch. They stood on a slope of 25° above a stream. The washing out of the roots was started with the 'Wajax' fire pump, Model DV0, developing about 5 h.p. and delivering 60 gal. of water per minute. The engine was operated to give 150 lb. pressure at the pump. This was not wholly satisfactory and the job was finished with the Bickle-Seagrove '150', which developed 25 h.p. and delivered 150 gal. of water per minute with the engine producing 175 lb. pressure at the pump. Two hoses were used, one to cut the soil and the other to wash it down the slope. After the roots were exposed they were carefully examined for abnormal conditions. Subterranean rhizomorphs of *Armillaria mellea* occurred among the roots of all five trees, and their abundance increased with the degree of decadence. An abnormal clumping of the rootlets, giving the appearance of witches' brooming, was observed. A similar condition of rootlets of Apple trees has been associated with low moisture content in the soil. Although the main roots in 4 out of the 5 trees were apparently healthy, many of the feeding rootlets were dead (pp. 39–47, 52).

[1460]. 47 : 12.26–8 : 45.3 : 13.2. NASH, R. W. **A serious situation confronts Birch.** *Timber of Canada* 6 (11), 1946 (61–5, 78).

After a general account of the nature and extent of die-back of Birch in the north-east of North America, the results of studies on sample plots in Maine are discussed. Figures from these studies show that the dominant class of

trees has the highest percentage of trees injured, severely injured, and dead; and the highest percentage of trees with increased injury from year to year, with the exception that in 1945 suppressed White Birch showed the most and quickest increase in injury. Details are given of the increase of injury from year to year, which is generally steady but sometimes shows an excess jump. There was a definite increase in injury in 1945, probably due to the late frosts and drought of the previous year. A strong correlation was found between decreased growth on a given plot and increased injury.

Control of the problem is a matter of management and utilization. Thinning of Birch stands should be avoided, and stands should be either clear cut or left alone. If pulpwood is cut in mixed stands, the Birch should be cut at the same time. In areas where Beech is being killed by Beech scale or *Nectria*, it is wise to cut the Birch while still merchantable. Birch stands must be given periodic inspection to ascertain their condition and changes therein. Cuttings should be confined and concentrated in the following order: (1) to extensively injured stands while still merchantable, (2) to Birch left in areas where other trees have been or are being removed, (3) to stands that show a reasonable expectation of dying, (4) to over-mature stands and those suffering from competition of softwoods growing up. The need of further research is stressed.

5. MENSURATION. INCREMENT. YIELD

52. MEASUREMENT OF TREES AND TIMBER

52.2. *Height. Length*

[1461]. 52.2 : 07.7. LIMING, F. G. **A sectional pole for measuring tree heights.** *J. For.* 44 (7), 1946 (512–4). [Central States Forest Experiment Station, Columbus, Ohio.]

The measuring pole described in this paper was developed to meet the need for a convenient and accurate instrument for making periodic measurements of several thousand trees on growth study plots. The trees, many of which were in dense stands, ranged from 1 to 32 ft. in height. The new pole makes it possible to measure these trees to the nearest tenth of a foot at the average rate of about one tree per minute. The important features are light weight (only 4 lb.); small size when unassembled (seven 4-ft. sections of bamboo, ¼–1 in. in diameter); arrangement of the scale on the pole so that heights greater than 4 ft. are read at a point 4 ft. above the base of the tree; conspicuous and flexible arm projecting at right angles from the upper end of the pole; simplicity of use; and low cost (cost of materials, including second-hand golf bag, was under $10).

52.4. *Measurement of Volume*

See also *For. Abstr.* 8 (No. 1539).

[1462]. 52.43.2 (52). ZUMWALT, E. V. **Log scaling in Japan.** *J. For.* 44 (7), 1946 (526–7). [Yale School of Forestry.]

The principal units of measure used in scaling logs in Japan are the *shaku*, a linear measure equivalent to 0·303 m. or 0·994 ft., and the *koku*, a volume measure equal to 10 cubic *shaku*, equivalent to 0·28 cu.m. or 9·82 cu. ft. Logs are scaled in a manner similar to that used in the west. The volume is determined from a log rule constructed according to the following formula:—

$$V = \frac{D^2 \times L}{10}$$

where V = volume of logs in *koku*, D = diameter at small end of log in *shaku*, and L = length of log in *shaku*. The conversion factor of 10 has been used for many years in changing *koku* to cubic feet, which is more convenient and probably more accurate than using the true value of 9·82.

[1463]. 52.43.3 : 12.26–8 (489). BORNEBUSCH, C. H., and HENRIKSEN, H. A. Bøgens Vedmassefaktorer. 1. Del: Formtalsbestemmelse ved Hjælp af Standardtabeller for mindre Bevoksninger af Bøg. **[The volume factors of Beech. Pt. I: Form-factor determination by means of standard tables for small Beech stands.]** *Forstl. Forsøgsv. Danmark* 18 (1), 1946 (1–96). [Dan.e.]

A statistical study of material from 28 small Danish Beech stands. The treatment of height classes 9–18 m. is a rough analysis only, and is neglected in the following remarks.

Special attention was given to the occurrence of forked trees. For forks chiefly within the

crown ($d_{0\cdot7-0\cdot9}$) the deviations of the form factor from normal were inconsiderable, whereas for forks chiefly below the crown ($d_{0\cdot1-0\cdot6}$) distinct deviations were found and such trees were excluded from the further treatment of the data. In practice, however, there would be scarcely any need to correct the form factor for forks, as the inclusion of all forks in the present material would have affected either the artificial stem form factor or the form factor of total volume only by about + 1 per cent., which is cancelled by a roughly equivalent negative error in measurement.

The bulk of the paper deals with the artificial stem form factor of undivided trees in the height classes 21–36 m. The relations of height and diameter to the form factor are considered on the basis of the collective treatment of data for single trees from all stands, and it is shown that the relationships so derived have little or nothing to do with actual form-factor differences between the stands as such. The remainder of the section examines the use of diameter quotients as an alternative index to form factor, and the diameter quotient $d_{0\cdot4}/d_{0\ 0}$ is shown to be the most reliable for this purpose.

In a similar study of the branchwood quotient (branchwood volume/stem volume) the possibilities of using crown ratio or diameter quotients for its determination are discussed and provisionally discarded in favour of determination from height and diameter graphs, which appears to be the best method in practice.

It is emphasized in conclusion that the study is limited to small woods and that its validity is restricted by this and by the relatively small material dealt with.

[1464]. 52.43.3 : 12.26–8 : 33.54 (931). KENDERDINE, C. A. B. **A volume table for Red Beech posts: Rangatana forest.** *N.Z. J. For.* 5 (2), 1945 (149–52).

An investigation was made to ascertain the number of fence posts that an efficient operator would obtain from mature Red Beech (*Nothofagus fusca*). The results are presented in tabular form.

[1465]. 52.43.3 : 12.26–8 (43.9). FEKETE, Z. Az egységes magassági görbék alkalmazása a fatömeg becslésére s a hazai átlagos tölgygörbék. **[Use of mean-height curves for determination of volume, and mean-height curves for Oak in Hungary.]** *Erdész. Kisérl.* 45 (1/4), 1943–4 (369–82). [Hu.g.f.]

The theory of the use of mean-height curves is discussed, with reference to the work of Wiedemann and Lang, and the author's own mean-height curves for Oak in Hungary are dealt with. The latter are given in a table indicating for each 5-m. mean-height class the heights in percentage of mean height against diameter ratios expressing diameters as decimal fractions based on mean diameter as unity. The practical procedure is: (i) Absolute height is converted to relative height by (*a*) taking a table value for the ratio actual/mean diameter; (*b*) reading off in a second table the relative height given against the diameter ratio found and the mean stand height. (ii) Further calculation is done as usual with volume tables. This method avoids the necessity of determining heights for the individual diameter classes.

[1466]. 52.43.4 : 12.26–8 (43.9). FEKETE, Z. Az átlagtörzs helye a faállományban. **[The place of the mean tree in the stand.]** *Erdész. Kisérl.* 45 (1/4), 1943–4 (383–93). [Hu.g.f.]

Using data collected for the construction of yield tables for Oak in Hungary, the author has examined: (i) The percentage frequency of the stem of mean basal area, based on number of stems in the stand, which he determines as 57·2 for the dominant and 57·7 for the total stand. Detailed data are given for 7 diameter classes and it is noted that the results differ markedly from Lang's. (ii) The percentage deviation of the true mean diameter based on volume from that based on sectional area and the meaning of this in terms of volume, finding the mean deviations to be 0·4 per cent. for diameter and 0·86 per cent. for volume, and the extreme deviations for volume to be – 3·6 and + 6·2 per cent. (iii) Determinations of volume, using the stem of mean sectional area and the Grundner-Schwappach volume tables, gave mean deviations, as compared with the height-curve method, of – 1·32 per cent. for timber (*Derbholz*) and only – 0·37 per cent. for total volume, and in the older age classes (91–180 years) the deviation for timber was only – 0·57 per cent. (iv) The arithmetical mean diameter and the mean diameter based on sectional area showed a mean difference of 2·37 per cent. in favour of the latter. *From author's summary.*

[1467]. 52.43.6 : 33.32. **Pulpwood volume measurement by water displacement.** *Paper Ind.* 28 (4), 1946 (526–7). P.R.

A brief account, with illustrations, of the apparatus used at the Ontario Paper Co., Ltd., Thorold, Ont., for measuring the volume of pulpwood by displacement of water. The pulpwood is delivered in 4 ft. lengths and is transferred by conveyors to cages, which are immersed in water tanks. With two cages working alternately on a 5-minute cycle for loading, immersing, reading of tank level, raising and discharging, more than 80 cords of wood can be handled in an hour.

[1468]. 52.46 (931) : 01.7. THOMSON, A. P. **A sampling approach to New Zealand timber cruising problems.** *N.Z. J. For.* 5 (2), 1945 (103–17).

Past difficulties of strip-cruising in New Zealand have been caused by abnormal variation in both density and type. These difficulties can be overcome by making 100-per-cent. tree tallies and sampling for volume only. In order to discover what intensity of sampling would be needed, the figures for past cruises were analysed and the coefficients of variation assessed. The results show that a sampling method would be perfectly applicable to medium or large cruises. A series of tests demonstrated that the errors entailed would be well within the prescribed margin. The major practical difficulty would be to assess coefficients of variation in advance. Various methods of doing this are discussed. The adoption of such a sampling system would result in very great savings in both field and office work. *Author's summary.*

54. FACTORS CONNECTED WITH ASSORTMENT

[1469]. 54 : 52.43.3. VOGEL, K. Ein Vorschlag zur Vereinfachung der Sortierung aufgenommener Bestände. [**A proposal for simplifying the determination of assortments in surveyed stands.**] *Allg. Forst- u. Jagdztg.* 119 (5), 1940 (133–7). [G.]

56. INCREMENT

[1470]. 56 (56.9) : 11.2. OPPENHEIMER, H. R. **Some cases of uncommonly rapid plant growth in Palestine.** *Repr.* from *Palest. J. Bot. (R. Ser.)* 5 (1), 1945 (112–23).

The author reports the results of sporadic observations on maximum growth rates for various trees and other plants under optimal conditions in Palestine. Among the tree species known to develop in that country at a very rapid rate are *Eucalyptus* spp., *Grevillea robusta*, *Pinus halepensis*, *P. canariensis*, *Cupressus macrocarpa*, *C. sempervirens*, *C. arizonica*, *Casuarina equisetifolia*, *Dalbergia sissoo*, *Parkinsonia aculeata*, and various species of *Acacia*. The author compares his results with data reported from other countries and emphasizes the need for a further study of the agricultural and silvicultural possibilities offered by the climate of Palestine, especially in the coastal region.

[1471]. 56 : 12.25. GREYERZ, H. VON. **In honorem abietis nostrae.** *Schweiz. Z. Forstw.* 97 (6), 1946 (254–6). [G.]

The 'Radelfinger' State Forest, Canton of Berne, is a particularly good Silver Fir site, as shown by the fact that some trees felled in the last 10 years had a volume of over 20 cu.m. at an age of 130–140 years. The increment of one stem was still 0·5 cu.m. per annum immediately before felling. Stem analyses of two Spruces and two Silver Firs on the same site in Aarberg (*Querceto-carpinetum aretosum*) are also in favour of Silver Fir, as shown by the following table:—

	Stem volume	
Age	*Spruce (cu.m.)*	*Silver Fir (cu.m.)*
I. At 70 years. .	1·17	1·73
At 90 „ . .	1·93	3·17
II. At 80 „ . .	1·29	3·91
At 100 „ . .	1·94	5·54

Figures for 25 out of 26 mixed stands in Aarberg (mostly Oak/Hornbeam region) were also clearly favourable to Silver Fir as compared with other conifers.

Von Greyerz quotes figures from Burger's investigations on crown and increment and calculates that the efficiency of Beech, Spruce and Silver Fir, as judged by the crown volume necessary to produce a unit volume of timber, stands in the ratio 1 : 1·74 : 2·38. A footnote by Burger points out that if density of wood is considered, this ratio will read 2·3 : 2·7 : 3·3.

[1472]. 56.02. **Does diameter growth response hold above d.b.h.?** *Tech. Note Lake St. For. Exp. Sta.* No. 222, 1944. p. 1.

Some 70 trees, ranging in size from 8 to 25 in. d.b.h., were measured after they had been felled in a second logging-over of a tract cut 17 years earlier and the ratios of growth at various heights above ground to d.b.h. were determined. These ratios were very similar for trees of all sizes, and it was evident that the forms of trees did not change following light selective cutting, and diameter growth response held at points above d.b.h., at least to the end of the second log. Thus, growth calculations based on periodic d.b.h. measurements and the application of volume tables will give a true picture of growth.

[1473]. 56.02 : 11.21 : 11.11 : 11.14.2 : 12.25 (489). HOLMSGAARD, E. Aarringsanalyser fra Midtjylland. **[Annual ring analyses in central Jutland.]** *Dansk Skovforen. Tidsskr.* 30 (5), 1945 (129–73). [Dan.dan.]

Ring breadths of the years 1919–43 are analysed (i) for Norway Spruce stands in Gludsted Plantation, which, owing to very low site quality and comparatively uniform soils, offered a good chance of detecting variations due to climate; (ii) for Scots Pine stands in Linaa Vesterskov, one of the optimum areas of this species in Denmark.

Mean annual ring breadths (i.e. the mean breadths for each individual year) were calculated. Comparison of these for the slowest- and quickest-growing trees revealed closely parallel fluctuations, as did also a comparison by whole age classes; hence mean annual ring breadth could be taken as a satisfactory basis of study. Correction for the effects of age consisted in plotting a 'normal' curve of mean ring breadths for each year of age on the basis of the whole material for each species, deriving from this a 'normal' curve for each stand to express variation of ring breadth with age in a hypothetical constant average environment, and stating the actual mean annual ring breadths in percentage of the 'normal' values.

(i) *Norway Spruce* (*Gludsted*): The mean annual ring breadths in percentage of 'normal' were twice as great in some years as in others, and several years of good or bad increment might occur in succession. The effect of thinnings on these figures would be negligible, though it is shown, for stands where data on years of thinning were available, that thinning could increase diameter increment by 10 per cent. in all of the first to fourth years after the operation. An analysis of climatic correlations indicates that precipitation during the early part of the growing season (April–July, and especially May–June) is the dominant factor for increment of Spruce in this area. No safe correlation with temperature was obtained, though there were indications that a high temperature is favourable if precipitation is adequate, and unfavourable if it is deficient.

(ii) *Scots Pine* (*Linaa Vesterskov*): There was no apparent difference in annual ring variations on different sites. One stand in 1935 formed a very narrow ring which is attributed with some certainty to attack by *Hylesinus piniperda*. The annual variations of ring breadth were rather less marked than those of Spruce, the broadest rings being scarcely twice as broad as the narrowest. Climatic correlations were the opposite of those for Spruce, i.e. there was an uncertain negative correlation of ring breadth with precipitation, and a positive correlation, particularly high for the months January–April, of ring breadth with temperature.

It is pointed out that the demonstrated variations will clearly affect increment determinations and predictions, the accuracy of which will depend more on the period concerned than on accuracy of measurement. Arranged by 5- and 10-year periods, the Gludsted Spruce figures for mean annual ring breadth in per cent. of normal vary from 80 to 119 (the difference being 49 per cent. of the lesser figure) for 5-year periods, and from 94 to 112 (or 19 per cent. of the lesser figure) for 10-year periods. Taken in 5-year periods, the extreme values for Scots Pine in Linaa Vesterskov are 91 and 109, a difference of 20 per cent. of the lesser figure. Hence the compilation of standard tables based on 'normal' diameter increment, arrived at by studies similar to the present one, should enable greater accuracy to be attained in many predictions of increment. [*Note*: A German version of this paper was published in *Schweiz. Z. Forstw.* 96 (12), 1945 (345–56).]

[1474]. 56.02 : 11.21. SCHULMAN, E. **Dendrochronology at Mesa Verde National Park.** *Tree-Ring Bull.* 12 (3), 1946 (18–24).

This report gives an index of the winter-season storminess at Mesa Verde, in south-western California, for 1,346 years, the climatic

records derived from increment cores of living Douglas Fir having been extended by the measurement of longer and more sensitive ring series in archaeological specimens.

[1475]. 56.02 : 11.21 : 11.6. SCHULMAN, E. **Tree-ring hydrology of the Colorado River Basin.** *Univ. Ariz. Bull.* 16 (4), 1945 (publ. 1946). pp. 51 + chart.

Series representing 59,900 dated and measured rings have been used to construct 52 locality growth indices of the larger tributary basins in the Colorado River system. The basin indices range from 285 to 696 years in length. A fair degree of correspondence is shown to exist between variations in annual ring growth, October–June rainfall, and water-year run-off. The effect, if any, of temperature fluctuations is not evident. *From author's summary.*

[1476]. 56.02 : 11.21 : 12.25. DOUGLASS, A. E. **Survey of *Sequoia* studies. II.** *Tree-Ring Bull.* 12 (2), 1945 (10–6).

A continuation of a previous bulletin [see *For. Abstr.* 7 (No. 981)], surveying studies of *Sequoia* tree-ring chronology, with particular reference to topographical influence. Upland trees give the best results, and basin trees are practically useless. The evidence of the value of a site for chronological purposes is the cross-dating between the trees therein. In the dry areas of the south-western United States, where the trees exist on a minimum of water supply, trees growing at or near places reached by no water except precipitation and places in which water has little or no chance for conservation, are the ones most likely to have ring records which cross date from tree to tree.

[1477]. 56.02 : 11.21 : 12.25 (74). LYON, C. J. **Hemlock chronology in New England.** *Tree-Ring Bull.* 13 (1), 1946 (2–4). [Dartmouth College, Hanover, N.H.]

57. DEVELOPMENT AND STRUCTURE OF STANDS. YIELD

[1478]. 57 : 12.25 : 23.1 : 24 : 09.7 (44). LEROY, R. Les forêts de mélèzes dans les Alpes Maritimes. **[The Larch forests in the department of Alpes Maritimes.]** *Bull. Soc. for. Franche-Comté* 25 (10; 11), 1945 (383–96; 418–30). [F.]

A general account is given of the distribution, extent, aspect, soils, etc., of the Larch forests of the Alpes Maritimes. The following data were obtained from 5 sample plots in the Tinée valley.

(1) *The influence of altitude on height of trees.*

No. of plot	1	5	2	4	3
Altitude of plot (m.)	1,250	1,520	1,700	1,820	1,980
Mean height of trees of 1·5 m. girth (m.)	30	27	22	21	20

Thus, the height of stands diminishes with increase in altitude.

(2) *Number of stems and basal area per ha.*— Placing the plots in order of increasing proportion of old wood, the following results are obtained:—

No. of plot	2	1	5	3	4
No. of stems over 45 cm. girth per ha.	608	345	288	151	140
Basal area per ha. (m^2)	38	37	32·5	30	26
Volume under bark per ha. (m^3)	240	370	280	200	170

(3) *Yield appears to be a decreasing function of girth of the average tree.*

No. of plot	2	1	5	4	3
Girth of average tree (cm.)	82	110	110	135	140
Yield per ha. (less bark) (m^3)	4·7	4·1	3·0	1·8	1·6

From the point of view of maximum yield, it is therefore advisable not to let the stands grow too old.

It is recommended that fully stocked stands should not be thinned prematurely but allowed to grow in the natural state until the trees attain a mean girth of 80–90 cm. A cleaning cutting may then be made in easily accessible stands, in order to remove crowded or suppressed trees. Twenty or thirty years later another thinning may be made, still reserving the *élite* trees. After the lapse of a similar period, the stand should be mature and ready for a seeding felling which should remove 30–40 per cent. of the growing stock, opening up fairly large gaps. If regeneration is established normally, the rest of the old material can be removed completely in two other fellings at intervals of 15–20 years. [Cf. *For. Abstr.* 8 (No. 986).]

[1479]. 57 : 12.25 (71.1). BRITISH COLUMBIA. **Report of the Forest Service: year ended December 31st, 1945.** King's Printer, Victoria, B.C. 1946. pp. 90 + plate.

A summary was made of the development of the virgin Spruce/Balsam type of the Upper Fraser over a period of 15 years. A general summary of the findings is as follows:—

	Spruce		*Balsam*	
	ft. bd. m.	*Per cent.*	*ft. bd.*	*Per cent.*
Annual increment per acre due to growth	184·5	1·14	85·5	1·00
Annual loss through mortality	121·0	0·75	253·1	2·97
Net annual increment	+63·5	+0·39	−167·6	−1·97

The Spruce increased 1·3 in. in diameter and the Balsam 1·1 in. in the 15-year period. The net volume of the Spruce stand above 18 in. d.b.h. remained constant for the 15-year period, the loss from trees dying offsetting the increment on the residual trees. This indicates that a flexible diameter limit of 18 in. in selective logging would remove the unproductive portion of the stand. The following table shows the change in composition which is taking place in the stand:—

Gross Volume per acre bd. ft., B.C. Scale

	Spruce		*Balsam*		
Year	*ft. bd. m.*	*Per cent.*	*ft. bd. m.*	*Per cent.*	*Total*
1928	16,125	65·4	8,519	34·6	24,644
1943	17,078	74·0	6,005	26·0	23,083

(p. 21).

[1480]. 57 : 12.25 (71.1). BRITISH COLUMBIA. **Report of the Forest Service: year ended December 31st, 1945.** King's Printer, Victoria, B.C. 1946. pp. 90 + plate.

A study was inaugurated to determine the empirical yield of the Hemlock types on the west coast of Vancouver Island and the Spruce/Hemlock type of Queen Charlotte Islands, through the use of permanent plots. An average annual increment of 700 bd. ft. (B.C. Rule) was attained in some areas. An over-all yield for all sites is estimated at 450 bd. ft. per acre per year. A field examination shows that, although at 60–80 years there will be a large volume per acre, there are so many small trees, and growth in quality and quantity is increasing so rapidly, that the stands will not be ready for cutting. A rotation of 100–200 years is indicated from the preliminary studies. After this age the stands begin to break down from various causes, though some trees will continue to grow rapidly for centuries (p. 17).

[1481]. 57 : 56 : 21.6 : 24.2 : 12.26–8 (489). BAVNGAARD, A. Hvorledes egaliserer Skoven sig, og hvad Betydning har det for Bestandsplejen? [**How does 'equalization' [of growth] occur in the forest, and what is its significance in tending operations?**] *Dansk Skovforen. Tidsskr.* 31 (5), 1946 (209–40). [Dan.]

Bavngaard emphasizes the ability of regeneration in natural forests to catch up with the old growth and to form with the latter apparently even-aged stands, a process which he terms 'equalization'. In truly even-aged stands the converse, 'differentiation', occurs—e.g. in the development of wolf trees—but 'equalization' also occurs side by side with 'differentiation'; in particular, wolves are often incapable of maintaining their lead in middle age, and are overtaken. The strong belief that heavy thinning promotes continued improved diameter growth appears from the scanty data available to be unjustified: why then do marginal and open-grown trees maintain a steady diameter increment (though possibly to some extent at the expense of height growth)?

Bavngaard would explain these phenomena as a result of suppressed branches living at the expense of the tree as a whole. He notes that on Beech trunks a furrow often runs from the base of a heavily shaded branch to ground level, suggests that excess of respiration over assimilation in suppressed branches may cause loss of increment before bringing about death of the branch, and quotes an increase in radial increment of an Oak from which the suppressed lower branches were removed, from an average of 5·4 mm. for the 3 years preceding to 9·0 mm. for the 3 years following the operation. On this view, therefore, 'equalization' results from weakening of trees by suppressed branches still living during the course of natural pruning: the largest-crowned trees with the largest branches are the more liable to such weakening, thus permitting finer-branched individuals to overtake them. The frequent attacks of *Lophodermium* on large Norway Spruce with large crowns may possibly be related to weakening of this nature.

Mørk-Hansen's advice on the thinning of Beech (young woods to be kept dense for natural pruning but thinned lightly and often; older woods to be thinned at increasing intervals and with increasing severity until natural pruning is no longer required, after which each thinning should give the tree as much space as crown and roots can use until the next operation) is recommended as likely to give the best natural pruning, restriction of branch size and thus the minimum weakening of the tree's growth, moderate crown development with maximum height growth, a large number of stems for selection at the time when natural pruning may cease, and the maximum percentage of timber volume in large clear boles. A table is included to show the yield to date of Beech in Tvede Skov, which in spite of light thinnings is 5 per cent. higher than that indicated by Møller's site-quality tables.

6. MANAGEMENT. WORKING PLANS. SURVEYS

[1482]. 6 (485) : 94.1. HAGBERG, E. Grundsätze der Forsteinrichtung und der Einschlagskontrolle in den Schwedischen Staatswäldern. **[Principles of forest management and control of fellings in the State Forests of Sweden.]** *Intersylva* 1, 1940–1 (387–99). [G.e.f.it.span.]

[1483]. 6 (71) : 97.1 : 11.4. GILL, C. B. **Land classification a first step in forest management.** *For. Chron.* 22 (2), 1946 (128–34). [Manitoba Forest Service.]

A general discussion of the usefulness of land classification in forest management, with some notes on the different soil zones of the Canadian prairie provinces.

60. GENERAL LAND MANAGEMENT

[1484]. 60 (54.2). CHATURVEDI, M. D. **Land management in the United Provinces.** Superintendent, Printing and Stationery, Allahabad, United Provinces, India. 1946. pp. 132 + plates + map.

An analysis of timber lands in the United Provinces reveals that their proportion is not so low as the figure for State 'forests' would imply. The area returned as 'culturable waste' includes about 4 million acres of timber lands of sorts. Tree growth along the Himalayan slopes should be preserved for physical rather than economic reasons and the area to be maintained under some sort of tree cover should be 84 per cent. of the total. In the Gangetic Basin, the fuel shortage of 10 million tons per annum in rural districts, which is at present made up by five times that amount of dung, can be met by a concerted drive to renovate groves and avenues, plant up canal and railway lands, control ravines and private forests, and create fuel plantations on land acquired for the purpose. Tenants should be encouraged to plant an average of two Babul (*Acacia arabica*) trees on each acre of their holdings, now that the Tenancy Act of 1939 confers on them the right to plant and own trees on their holdings. As in the Himalayas, the tree growth in the Central Indian Plateau is to be preserved on physical rather than economic grounds. Twenty-four per cent. of the total area should be so maintained.

60.2. *Management of Tree Plantations under Non-forest Conditions*

[1485]. 60.2 (54) : 23.24 : 23.27. RANDHAWA, M. S. **A tree plantation plan for**

northern India. *Indian Fmg.* 6 (8; 9), 1945 (347–9; 394–7). [Imperial Council of Agricultural Research.] O.R.E.

India should have a national plan for (1) amenity planting for compounds of private and public buildings, town roads and parks; (2) avenues of trees along national, provincial and district highways; (3) fruit trees on canal roads; and (4) village plantations for the provision of fruit, timber and fuel. Among the species recommended for the timber and fuel plantations are Babul, Shisham, Bakain, Mesquite and Dhak.

The annual celebration of a 'Tree Plantation Week' would create public interest in the planting of ornamental and useful trees. Information is given on the preparation of pits, transplanting, weeding and hoeing, irrigation, and the training of ornamental trees. The author recommends the expansion of existing nurseries and the development of new nurseries in the headquarter towns of all districts under the Municipal and District Boards and the Public Works Departments.

[1486]. 60.2 : 23.24 : 91.3. WALKER, J. **Tree planting near dugouts and dams.** *Publ. Dep. Agric. Can.* No. 629, 1945. pp. 15. [Forest Nursery Station, Indian Head, Saskatchewan.]

On many prairie farms a dugout or dam is the only possible or immediate source of water for domestic and general use, and where sufficient water can be impounded it provides the farmer with some of the benefits of irrigation, particularly a farm garden. The contribution of a well planned tree belt in increasing the usefulness of these small water developments is set forth in this publication.

60.3. *Management of Different Classes of Forest*

[1487]. 60.31.2 (71.3). MORISON, M. B. **Management problems and solutions of small timber holdings in Ontario.** *Timber of Canada* 6 (8), 1945–46 (72, 74, 80). [Division of Timber Management, Ontario Department of Lands and Forests.]

A plea for the use of working plans for small timber holdings in Ontario, in order to ensure management for sustained yield.

[1488]. 60.31.2 (75.8). PHILLIPS, J. E. **Woodland management in Georgia.** *Bull. Ga. agric. Ext. Serv.* No. 466, 1944. pp. 32.

A revision of an earlier pamphlet designed to instruct the general public in good forestry methods in Georgia.

61. SURVEYING. MAPPING

[1489]. 61.32. EARDLEY, A. J. **Aerial photographs: their use and interpretation.** Harper and Brothers, New York and London. 1942. pp. xxii + 203. Price $2.75.

This book is the first volume in the publishers' Geoscience Series, and is a revised and expanded eighth edition of the author's 'Interpretation of Geologic Maps and Aerial Photographs'. It is intended primarily as a textbook for students and a practical guide to both class and field work. Early chapters deal with the uses and limitations of aerial photographs as maps, the use of the stereoscope, the making of mosaics and the interpretation of cultivation. The latter part deals with the geological interpretation of aerial photographs. The principles of interpretation of geological maps are explained and each principle is applied to the interpretation of the aerial photographs and mosaics which form the major part of the 46 plates illustrating the book. Forty-six figures are also included, there is an index, and each chapter has its separate bibliography.

[1490]. 61.32. SONLEY, G. R. **Interim report on experimental air photography for forest-cover classification.** *For. Chron.* 22 (2), 1946 (157–8). [Standing Committee on Surveys, Canadian Society of Forest Engineers.]

The R.C.A.F. made an experiment in infra-red photography for the purpose of forest-cover classification, in August 1945, using infra-red and aerokodacoler films, and control exposures were made on super XX, the standard film now used. The colour film was so underexposed that no conclusions could be drawn from it. The infra-red film gave very good results and it is concluded that infra-red photography separates hardwood and softwood stands, though it may not separate conifers scattered singly through hardwoods. It apparently has no disadvantages in the matter of storage and development, and when the minus blue filter is used the infra-red film has the same speed as super XX.

[1491]. 61.32. LOOMIS, R. D. **Aerial photogrammetry applied to forest surveying.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 849 (A–2–b), 1946. pp. 6. P.R.

When estimating timber from aerial photographs, variables such as species distribution, height, and density are divided into classes, each represented by a symbol. A combination of these symbols makes up a type class which is then transferred to a topographic map. Aerial work is checked by field work and, from the results, estimates for the area in question can be compiled. In order to compare two systems of field checking, two estimates were made of the same area. The first estimate was made from a 5-per-cent. check run in the usual way. The second estimate was made from information obtained from a 1-per-cent. field check and the aerial type map. The field check consisted of tallying on the ground ¼-acre plots selected from the photographs. The subsequent cutting of one of the areas thus estimated and a comparison of figures showed that, in this case at least, the latter method was more accurate. It is also cheaper and allows greater scope for examining the tract for logging possibilities and timber quality. An appendix gives notes on the 'intensity' theory as applied by the Aerial Surveys Division of the Dominion Forest Service.

[1492]. 61.32. CHURCH, E. **Determination of the scale data for two aerial photographs from one control line and three additional elevations.** *Bull. aer. Photogram. Syracuse Univ.* No. 13, 1942. pp. 25.

The analytical method described in this paper is for determining the scale data (exact altitudes of the exposure stations, the tilts, and the swings) for two overlapping aerial photographs. The control data consist of the length of one line, the elevations of the terminal points of this line, and the elevations of 3 additional points, all 5 points appearing in the area of the overlap of the two photographs.

[1493]. 61.32. CHURCH, E. **Notes on the rectification of tilted aerial photographs.** *Bull. aer. Photogram. Syracuse Univ.* No. 14, 1944. pp. 28.

The object of the pamphlet is to treat the subject of rectification thoroughly and simply. No geometric principles are assumed: all are proved. All formulas used in the operation of rectifying cameras are derived and expressed in practical form. The mathematics involved is not difficult.

[1494]. 61.32. CHURCH, E. **Revised geometry of the aerial photograph.** *Bull. aer. Photogram. Syracuse Univ.* No. 15, 1945. pp. 56.

[1495]. 61.32 : 61.4 : 07.7. CHURCH, E. **Discussion of a photogrammetric method for constructing topographic maps from aerial photographs.** *Bull. aer. Photogram. Syracuse Univ.* No. 16, 1945. pp. 16.

The purpose of this paper is to discuss briefly a proposed simple and cheap stereoscopic instrument for plotting topographic maps in correct orthogonal projection to any desired scale, from aerial photographs. No model of the proposed plotting machine has been constructed at Syracuse and the paper is purely theoretical.

[1496]. 61.32 (54.7). GRIFFITH, A. L. **Aerial reconnaissance for forest officers.** *Indian For.* 72 (5), 1946 (207–9 + plates).

Account of an amateur attempt at air reconnaissance and photography during a fairly extensive tour of the Thar desert of Sind, with photographs demonstrating the type of detail useful to a forester, that can be obtained by oblique shots.

64. DESCRIPTION OF SITE. ASSESSMENT OF SITE AND STAND QUALITY

[1497]. 64 (485) : 12.19.2 : 11 : 09.7. TAMM, O., and WADMAN, E. Om skogens naturliga betingelser i Hamra revir. [**On locality factors and their correlation with forest conditions in the Hamra State Forest District.**] *Suppl.* to *Svenska SkogsvFören Tidskr.* No. 2, 1945. pp. 79 + tbls., gphs., maps. [Sw.e.]

An extensive report on research in the Hamra State Forest District, western Gävleborg, on the relation of site factors to the distribution of forest (ground-vegetation) types, tree species (chiefly Scots Pine, Norway Spruce and Birch), and site-quality classes. An introductory section and a chapter outlining the geography and geology of the region are followed by chapters: (*a*) on correlations between

forest conditions on the one hand and elevation, topography and bedrock on the other; (*b*) on forest conditions as related to the physical texture of the moraines; (*c*) on a special comparative study made in an attempt to determine the reasons for the existence of poorer forest in one area; (*d*) a discussion of the main results and their silvicultural importance within the area and probably for much of the forest land of Northern Sweden.

The major conclusion from the results obtained is that soil moisture conditions are the dominating site factor in the district and exert a very strong influence upon the forest ground-vegetation types, the natural distribution of tree species, site quality, and thus on conditions for regeneration. In turn, the main factors affecting soil water are precipitation, aspect of slopes, and the fine-earth content of moraines. In areas of roughly equal water supply, forest conditions can also be correlated with type of bedrock.

There is an 8-page English summary, to which are appended translations of the legends of figures and tables.

[1498]. 64 : 56.01 : 11.3 : 12.25. GREAT BRITAIN. **Twenty-first annual report of the Imperial Forestry Institute: academic year, 1944–45.** University of Oxford. 1946. pp. 16.

Data collected in Mynydd Ddhu Forest during a soil survey have been analysed statistically and correlations found to exist between height growth of European Larch, Japanese Larch, Sitka Spruce and Norway Spruce, and one or more of the factors, soil depth, elevation, aspect and slope. This work brings out the frequently misleading character of direct observation, and the necessity of isolating the influence of any one factor under consideration from that of others acting simultaneously, if the importance of its real influence on growth is to be determined. The correlation between elevation and height growth was also further examined in connexion with the data collected in war felling areas in 1940 and 1941. It had been shown that height quality was negatively correlated with elevation, but that this correlation might be obscured if data collected in regions of different topographical type were confounded. An attempt has been made to determine what might reasonably be considered a normal relation between height quality and elevation for Norway Spruce and European Larch in hilly country in the north and west of Britain (p. 4).

65. DESCRIPTION OF GROWING STOCK

[1499]. 65 (494) : 56.3 : 09.4. BAUER, S. Vorschlag für eine Statistik über Holzvorrat und Zuwachs. **[Proposal for statistics of growing stock and increment.]** *Schweiz. Z. Forstw.* 97 (5), 1946 (212–4). [G.] KNUCHEL, H. Bemerkungen zur geplanten Vorratsstatistik. **[Comments on the planned statistics of growing stock.]** *Schweiz. Z. Forstw.* 97 (5), 1946 (214–6). [G.] NAGEL, J.-L. Statistique fédérale du matériel sur pied et de l'accroissement. **[Federal statistics of growing stock and increment.]** *Schweiz. Z. Forstw.* 97 (7), 1946 (322–4). [F.]

For Bauer's paper see abstract of French version, in *For. Abstr.* 7 (No. 2128).

Knuchel agrees on the principle and that the time for such a plan is opportune, but stresses the lack of uniformity in working-plan computations in different Cantons. Federal regulation to secure uniformity is neither immediately possible nor likely to be desirable. On the other hand, the Cantons could very well conform freely in certain minor particulars, e.g. methods of enumeration, diameter-class limits, etc., to a uniform practice, for which the standards employed in the preparation of working plans for diplomas at the Federal Technical College might well be adopted.

Nagel approves of Bauer's proposal so far as growing stock is concerned, but sees no need for a uniform system of measurement for the whole of Switzerland, especially as the latter would prevent Cantons already having long-standing statistics, based on their own practice, from making good use of their material. The same objection applies with even greater force to records of increment, and considering this and the difficulties inherent to determination of increment, it is suggested that the compilation of Federal statistics for increment should be postponed until exact data are available on the growing stock.

7. FOREST ECONOMICS, VALUATION, AND FINANCE

74. VALUE OF THE STAND. VALUE OF THE FOREST

[1500]. 74.2 : 52.43 : 57.0 : 01.7. BARTON, W. W., et al. **Instructions for computations: physical and financial stand structure analysis for the old growth northern hardwood and Hemlock forest.** U.S. Forest Service, Milwaukee, Wisconsin. 1943 (revised). pp. 12 + 114.

This handbook gives a detailed account of a tested method of making a physical and financial stand-structure analysis for the purposes of managing northern hardwoods. The basis of the analysis is a set of tree-classes based on value as well as vigour and chance of survival. The stand analysis starts with an inventory of the forest, in which trees are tallied by tree class, species, d.b.h., and cut or leave. The essence of this method of analysis is that it recognizes that not all trees of the same species and size have the same value and growth potential.

76. MANAGEMENT STATISTICS

[1501]. 76 : 84 (494). TROMP, H. Die Selbstkostenrechnung in der Forstwirtschaft. **[Calculation of the cost price in forestry.]** *Schweiz. Z. Forstw.* 97 (8/9), 1946 (378–98). [G.f.]

The calculation of the cost price of the outturn is held to be necessary both for internal rationalization of the enterprise and as a means of presenting a good case when questions of price policy arise. In contradistinction to business accountancy, the normal method of accountancy in Swiss public forestry distinguishes only expenditure and receipts *within* and not *for* a given financial period, and takes no account of costs proper. The author examines the peculiarities of forestry as an enterprise and makes a theoretical analysis of the nature of capital and costs therein, concluding that a commercial type of accountancy and calculation of cost prices of the outturn as a whole or by assortments, is possible in principle.

[1502]. 76 : 84 : 94.3 (485). UGGLAS, C. AF. Studie i det mindre skogsbrukets bokförings-fråga. **[Study on the question of bookkeeping for small forest properties.]** *Svenska SkogsvFören. Tidskr.* 44 (2), 1946 (182–97). [Sw.]

A brief discussion of principles applicable to small forest estates and farm woodlands, with a comparison of forest with agricultural bookkeeping, and sections on stumpage value, accounting for material converted on the spot, silvicultural costs, etc., practical form of the books, and accounting for the growing stock. Specimen layouts for the accounts and for the annual statement of results are appended.

[1503]. 76.1 : 32. MATTHEWS, D. M., and WILLARD, J. A. **Preplanning of logging operations for minimum costs.** *Paper Tr. J.* 122 (6), 1946 (43–7). L.S.

The extreme variability of logging operations makes it difficult to set standards for operating costs although their need is recognized. Information required for adequate preplanning includes volume per acre, and costs of skidding, loading, hauling and the construction work that is attendant. With this information it is possible, with the data given, to analyse and estimate transportation costs. Examples are presented illustrating the use of the formulas which the authors have developed. *Authors' summary.*

[1504]. 76.3 : 84 : 78. GRØN, A. H. Sand Nettofortjeneste ved Skovbrug. **[True net income in forestry.]** *Svenska SkogsvFören. Tidskr.* 44 (3), 1946 (205–22). [Dan.e.]

Net income, in business accountancy, is the value of the concern at the end of an accounting period minus its value at the beginning of the period plus consumption during the period. Grøn presents diagrammatically the accounts and entries necessary, on a business accountancy basis, for an estate growing one species only, and analyses the entries that would take place, assuming for simplicity that all transactions are made in cash, during a financial year.

Only two entries cause real difficulty, namely the value to be assigned in the opening balance to the forested area and that to be assigned in the closing balance to the change in value during the year as a result of plantings, etc., and of increment. This has been the dominating problem discussed in the literature of forest accountancy, but the question is of less fundamental importance than might appear, for in

practice the increase or decrease in value can be assessed by other means.

The two great technical difficulties are: (*a*) That the volume increment of a single year lies within the margin of error of the measurement of the growing stock. Thus annual balances can be provisional at best and must be corrected at the end of a longer period—at least 5 years to meet the technical mensurational requirements, and preferably 12 years to allow for climatic variations [cf. *For. Abstr.* 8 (No. 1473)]. This type of problem arises in all long-term businesses and is solved in insurance, for instance, by good probability statistics. (*b*) That value increment is not directly proportional to volume increment. The merits of applying to this question the principle of realization value or that of production value (a type of expectation value) are compared, with the conclusion that on the whole the latter has by far the greater advantages, its chief disadvantage—that of dependence on rate of interest—being shown to lose significance in the case of a relatively large forest estate under continuous management.

The special application of this principle lies in the device of splitting the expectation value of a stand into (*a*) a volume or material element, and (*b*) a price element. For (*a*) it is possible on the basis of good increment tables to construct tables of *expectation volume* by assortments or age classes, and it is shown that the *expectation volume increment* in one year is p per cent. of the expectation volume at the start of the year. Hence a balance can be drawn in terms of material, which may be converted into terms of money by multiplying expectation volumes by (*b*) the price element, which is the price per unit volume obtained during the actual year for the assortments concerned. Net income is thus determined as p per cent. of the initial expectation volume × actual prices per unit of timber.

It is now sufficient at the beginning of the accounting period to draw up an expectation volume status based on direct measurement of stand data, whereafter this status can be carried forward year by year, additions being made for expectation volume increment for the original area and for any areas accruing from other use, and deductions for fellings, areas transferred to other use, losses from natural catastrophes, etc. Only after 5 or, better, 12 years is adjustment made to conform with the results of direct remeasurement. An annotated tabular example is given to illustrate the application of this method, the main disadvantage of which is that *a priori* assumptions are made about growth and fellings; and the main advantages, besides what is evident from the above, that over- and undercutting are registered as capital losses and gains and that loss by natural catastrophes is taken into account in the year of its occurrence.

78. CALCULATION OF PRESENT AND FUTURE VALUES

[1505]. 78 : 57 : 12.25. LANGSÆTER, A. Hjelpetabeller ved økonomiske kalkyler i skogbruket. II. Ventemassetabeller for gran. [**Auxiliary tables for economic calculations in forestry. II. Expectation volume tables for Norway Spruce.**] *Medd. norske Skogforsøksv.* 9 (3) (No. 33), 1946 (357–92). [Nor.]

Tables of expectation volume under bark, for Norway Spruce on different site qualities, rotations and rates of interest, are presented with a discussion of their use. Further tables are appended for the calculation of planting costs, etc., to show the values of

$$\frac{1{\cdot}0p^q}{1{\cdot}0p^n - 1}$$

as affected by rate of interest, rotation, and age. [Cf. *For. Abstr.* 7 (No. 2142).]

8. FOREST ADMINISTRATION

81. ORGANIZATION. REGULATION OF SERVICE

[1506]. 81 (73). BROOKS, J. F. **Woods forestry.** *J. For.* 44 (6), 1946 (439–40).

The writer deplores the tendency in the United States to expect a forester to assume and carry out responsibilities for many matters such as buying and selling land, marketing forest products, directing logging operations, organizing fire protection, which leave him little time for his essential task of silviculture and management.

82. LABOUR QUESTIONS

[1507]. 82 (47.1) : 32.25. Muus, H. Mesterskabskonkurrence for Skovarbejdere i Finland. **[Wood-cutters' championship competition in Finland.]** *Dansk Skovforen. Tidsskr.* 31 (4), 1946 (157–65). [Dan.]

Notes on the 1945 wood-cutting competition, with tabular analyses of the performance and timings of the best competitors. The winner, Ahonen, felled, converted and stacked 56 stacked cu.m. in 4 8-hour working days. [Cf. *For. Abstr.* 7 (Nos. 2147–8).]

[1508]. 82 (485). Wahlund, S. Skogsbrukets arbetskraftsproblem. **[The manpower problem in forestry.]** *Svenska SkogsvFören. Tidskr.* 44 (2), 1946 (93–102). [Sw.] Wesslén, G., Mattsson Mårn, L., et al. Arbetskraftsfrågor inom skogsbruket. Föredrag vid Svenska Skogsvårdsföreningens årsmöte 1946. **[Manpower problems in forestry. Lectures delivered at the 1946 annual meeting of the Swedish Forestry Association.**—With discussion.] *Svenska SkogsvFören. Tidskr.* 44 (2), 1946 (103–67). [Sw.]

Conference papers by: S. Wahlund on Swedish population trends with special reference to forestry; G. Wesslén on the general problem of manpower in forestry; L. Mattsson Mårn on the significance of forest labour contracts and agreed price scales for jobs, with special mention of the classification of winter felling jobs in 7 difficulty classes by a points system; A. Elgstrand on organizational possibilities of improving conditions for labour (training, reduction of seasonal in favour of more continuous occupation, etc.); G. Luthman on mechanization and tools in forestry and on organizational experiments begun in central Sweden; and discussion by eleven contributors.

[1509]. 82 (71). Lamothe, G. E. Main-d'oeuvre forestière. **[Forest labour.]** *For. québec.* 11 (5), 1946 (365–76). [F.]

At present there is a shortage of 14,000 men in the pulpwood industry in Quebec alone, and the principal fault of the Canadian forest labour force is its lack of stability, although wages are high and unemployment is already beginning in the country as a whole. The cause of this, in the writer's opinion, is the industry's bad name, largely because of fluctuations in wages in the past. This is borne out by the average age of a Canadian woodcutter (24–25 years). The cure appears to be more mechanization and greater concentration of felling, which means larger camps with more amenities.

[1510]. 82 : 07.7. Le Sueur, A. D. C. **Safety for tree workers.** *Quart. J. For.* 40 (2), 1946 (88–90).

The safety belt as such is not really satisfactory, as the jerk at the end of a fall may cause internal injuries. If provided with thigh loops, which convert the belt into a 'saddle', such danger is greatly lessened. At the moment, these saddles, made in the United States, are very difficult to obtain, but a satisfactory alternative is the rope 'safety sling', standard safety apparatus of the U.S.A. National Parks Department. This is made from a piece of high-quality, $\frac{1}{2}$-in., manila rope 100 ft. long. At one end a double bowline is made to fit the worker, one loop going round the body, the other round the thighs. A 6-ft. length is left beyond the bowline and is fastened with a locking hitch to the standing end of the rope as it hangs from the fork or branch over which it has been passed. A large loop or sling is thus made, which can be increased or lessened by sliding the locking hitch along the standing end. Details are given of the locking hitch, which must be worked tight and kept tight and inspected at intervals. The locking hitch is not infallible, but instances of failure are very few.

[1511]. 82 : 32.25. Chant, D. B. **Axe cuts: a study of the nature and the causes of axe injuries in pulpwood logging operations.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 807 (J–1), 1945. pp. 6 + tbls. [Ontario Pulp and Paper Makers' Safety Association, Toronto, Ont.]

Of 969 accidents investigated, more than one-third (374) occurred in the course of limbing, topping or marking logs for cross-cutting. Only 120 occurred during undercutting or felling. A very large proportion of accidents are caused by the axe glancing, and it is considered that many might be avoided if greater attention were given to correct hanging, balance and sharpening of axes.

9. FOREST POLICY

[1512]. 9 : 06.2. **The work of FAO.** United Nations Interim Commission on Food and Agriculture, Washington. 1945. pp. v+57.

[1513]. 9 : 06.2. **First report to the Governments of the United Nations by the Interim Commission on Food and Agriculture.** [United Nations Interim Commission on Food and Agriculture], Washington. August 1, 1944. pp. 55.

[1514]. 9 : 06.2. **Second report to the Governments of the United Nations by the Interim Commission on Food and Agriculture.** [United Nations Interim Commission on Food and Agriculture], Washington. July 16, 1945. pp. 3.

90. GENERAL PRINCIPLES OF FOREST POLICY

[1515]. 90. KÖSTLER, J. Die Zukunft der Forstwirtschaft. **[The future of forestry.]** *Intersylva* 1, 1940–1 (13–26). [G.e.f.it.span.]

[1516]. 90 (410). BADOUX, E. La question forestière en Grande-Bretagne: un nouveau plan de reconstitution. **[The forestry situation in Great Britain: a new plan for rehabilitation.]** *Schweiz. Z. Forstw.* 97 (4), 1946 (161–6). [F.]

[1517]. 90 (489) : 76 : 35. GRØN, A. H. Dansk Skovbrugs økonomiske Vilkaar 1935–1945. **[Economic conditions in Danish forestry, 1935–45.]** *Dansk Skovforen. Tidsskr.* 31 (5), 1946 (241–69). [Dan.]

From a consideration of prices for the chief Danish forest products (particularly those of the predominant species Norway Spruce and Beech) in relation to costs of production and the effects of war-time price controls and obligatory excess fellings (chiefly of Beech fuelwood), the data being computed on the basis of unit areas of hypothetical normal forest, Grøn concludes that for Norway Spruce and other conifers the economic conditions are still comparatively satisfactory, except on the very lowest site qualities, whereas for Beech and other hardwoods the economic situation has become intolerable. Though it has been repeatedly urged from official quarters that the raising of hardwoods, especially Beech, should continue as widely as possible, Beech forests are becoming a luxury that only State forestry can allow itself. The responsibility for this situation lies with the wage, price and tax policies pursued in recent years, and to some extent with the forest owners, who have been able neither to supply satisfactory figures in proof of their case nor to make their voice sufficiently heard. As things now stand, any further rise of costs, e.g. of property tax or wages, will mean that hardwoods can only be grown at a loss, unless there is a corresponding increase in returns, which can only come about if timber prices are freed from control and are allowed to find their own level in relation to prices on the world market. [Cf. *For. Abstr.* 8 (Nos. 163, 621–2, 778).]

[1518]. 90 (51). CALDWELL, D. H. **Problems in Chinese forestry.** *J. For.* 44 (7), 1946 (497–8).

The writer notes the shortage of timber, lack of protection against fire and grazing, lack of trained foresters, and need of soil conservation. [Cf. *For. Abstr.* 7 (Nos, 1042, 2160).]

[1519]. 90 (54). INDIA. **Forest policy.** *Indian Fmg.* 7 (1), 1946 (42–3). *Repr.* from *Eastern Economist*, Sept. 7, 1945. O.R.E.

[1520]. 90 (71). BATES, J. S. **A broader approach to Canada's forest problem.** *Timber of Canada* 6 (9), 1945–46 (44, 58).

A comparison is made between the forests of Sweden and those of Canada. Sweden is one-twentieth the size of Canada; forest covers about the same percentage (57) of both countries. Sweden's annual wood crop, without cutting beyond average rate of growth, is nearly two-thirds of Canada's total cut or, disregarding firewood in both cases, nearly three-quarters. Loss from fire, insects and disease is said to be considerably less than 5 per cent. of the annual wood cut in Sweden's well balanced forests while Canada suffers to the extent of 35 per cent. The estimated rate of growth over the whole forest area of Sweden is double the rate for the best Canadian forests. The obvious need for more intensive and scientific management is urged.

[1521]. 90 (71.1) : 91.8. BRITISH COLUMBIA. **Interim report; Appendix to interim report; Supplementary report, with appendices.** Post-war Rehabilitation Council, Parliament Buildings, Victoria, British Columbia. 1943–44. pp. v + 205; pp. 422 + map; pp. 122 + 41 + map. **A summary of recommendations contained in the Interim Report (1943) and Supplementary Report (1944).** Post-war Rehabilitation Council, Parliament Building, Victoria, British Columbia. 1944. pp. 42.

Among the recommendations made in this report is one that the Forest Branch should establish demonstration stations at suitable points throughout the Province for the purpose of demonstrating to farmers and others the methods of planting and growing trees for 'wood-lot farming'. The Council is of opinion that the cost of such demonstration would repay the Province many times over in the course of time, by the production of useful timber and profitable employment for farmers.

[1522]. 90 (78.6). **State of Montana: report of the Forest Lands Advisory Commission appointed by the Governor under authorization of the twenty-eighth session of the State Legislature.** Forest Lands Advisory Commission, State University, Missoula, Montana. 1945. pp. 48.

[1523]. 90 (946) : 8. KESSELL, S. L. **Preliminary report on the forests and forestry administration of Tasmania (dated 21st August, 1944).** Govt. Printer, Tasmania. 1945. pp. 12. KESSELL, S. L. **Report on the forests and forestry administration of Tasmania.** Govt. Printer, Tasmania. 1945. pp. 18.

The terms of reference of these reports were mainly confined to the forest administration and the issue of licences or permits to sawmillers. A number of recommendations are made, all with the aim of conserving the existing resources, and it is particularly recommended that no new pulping or similar woodworking companies should receive permits until a complete survey of forest resources has been carried out. It is recommended that when softwood plantations are established, they should be so located in relation to existing hardwood forests that the same labour force can be used for fire protection of the whole forest area in summer and on plantation work during the rest of the year. It is recommended that the present spacing of 6 × 6 ft. for *Pinus radiata* should be increased to 7 × 7 ft. where markets exist for thinnings and to 8 × 8 ft. in other cases.

[1524]. 90 (946) : 8. STEANE, S. W. **Comments on the Kessell Report.** 1945. pp. 12. [Forestry Department, Tasmania.]

Comments by the Conservator of Forests on the Kessell report [see preceding abstract], with notes on action taken, or being taken, on its recommendations.

91. SOCIAL AND ECONOMIC INFLUENCE OF THE FOREST. NATIONAL PARKS. RESERVES. FOREST INFLUENCES

[1525]. 91 (44). DUGELAY, A. Le retour à la terre et le problème sylvo-pastoral dans les Alpes-Maritimes. [**The return to the land and the silvo-pastoral problem in the Alpes Maritimes.**] *Rev. Eaux For.* 81 (4; 5; 6; 7; 8), 1943 (141–53; 221–33; 280–90; 339–51; 416–32 + plates). [F.]

A detailed examination of the problem of depopulation in the Alpes Maritimes, with the object of refuting the allegation, often made, that the admitted decrease in rural population is directly due to the reforestation of the last 60 years and the policy of the forest authority.

[1526]. 91 (64). CHALLOT, J.-P. L'homme et la forêt marocaine. [**Man and the forests of Morocco.**] *Rev. Eaux For.* 84 (5), 1946 (233–61). [F.]

The forests of Morocco consist for the most part of relatively young stands of Evergreen Oak, resulting from the frequent fires before the pacification of the country, and cover some 3,900,000 ha. They are the property of the State, but subject to the rights of tribesmen for fuel and pasture. A system of management based on the principle of periodic and progressive thinnings is being tried, which is intended to reconcile the interests of the tribesmen with good forest practice. This permits the production of fuel without waiting for the normal age of exploitation of the stand; does not entail complete exclusion of stock such as is necessary to protect young growth after clear felling; improves pastoral conditions by making movement and supervision of stock

easier and providing additional forage in the form of sprouts from felled trees; and provides opportunity of continuous work for an important body of workers. Some success has already been achieved in accustoming the Berber herdsmen to these ideas.

91.1. *Rural Preservation. Reserves. National Parks. Plant and Animal Protection*

See also *For. Abstr.* 8 (Nos. 978–80).

[1527]. 91.1 (410). GREAT BRITAIN. **National nature reserves and conservation areas in England and Wales: report by the Nature Reserves Investigation Committee. Conference on Nature Preservation in Post-War Reconstruction.** *Mem.* No. 6, 1945. pp. 82. [Society for the Promotion of Nature Reserves, British Museum (Natural History), London, S.W.7.]

The Committee have considered and sifted a large number of proposals for conservation, and have reduced their recommendations to the minimum compatible with the presentation of a national plan. The principle of the Conservation Area forms the backbone of the scheme. Twenty-five such districts, together with 3 National Parks, are proposed for England and Wales. Forty-seven Nature Reserves, within these larger areas, are proposed.

[1528]. 91.1 (485). AMINOFF, F. Naturschutz in den Wäldern Schwedens. [**Nature protection in the forests of Sweden.**] *Intersylva* 1, 1940–1 (206–18). [G.e.f.it.span.]

[1529]. 91.1 (73) 34.3 : 92. RUTHERFORD, R. M. **Pittman-Robertson contributions to forest game restoration and management.** *J. For.* 44 (6), 1946 (419–23).

The U.S. Federal Aid in Wildlife Restoration Act of 2nd September, 1937, popularly known as the Pittman-Robertson Act, was designed to provide aid to the states for the restoration of wildlife. During the first 7 years of operation, substantial progress has been made towards better management of forest wildlife and bringing back vanished species to suitable habitats. Some account is given of measures taken to deal with both overstocking and understocking of game, with particular reference to the difficulties of winter feeding of deer.

[1530]. 91.1 (74.7). COOK, D. B., and EDMINSTER, F. C. **Survival and growth of shrubs planted for wildlife in New York.** *J. Wildlife Mgmt.* 8 (3), 1944 (185–91). B.A.P.

91.3. *Influence of the Forest on the Environment*

See also *For. Abstr.* 8 (Nos. 887–91).

[1531]. 91.3 : 11.62. BURGER, H. Der Wasserhaushalt im Sperbel- und Rappengraben von 1927/28 bis 1941/42. [**The water economy in the Sperbel and Rappen watersheds from 1927–28 to 1941–42.** *Transl. U.S. For. Serv.* No. 368, 1945. pp. 39. [E.] *Transl.* from *Mitt. schweiz. Anst. forstl. Versuchsw.* 23 (1), 1943.

Cf. *For. Abstr.* 6 (122).

[1532]. 91.3 : 11.6 : 42.51. MACLEAN, W. E. **Forests and hydro-electric power.** *Aust. Timb. J.* 12 (2), 1946 (78, 80–1, 91, 93).

The writer emphasizes the importance of adequate forest cover in catchment areas feeding hydro-electric plants, in order to conserve water and maintain a steady flow. When water-power developments are contemplated, consideration should be given to the types of industry that it is proposed to supply with power, because they may prove a menace to the district. Wood-pulp mills, for instance, might deforest the headwaters of important streams. Chemical plants, by the discharge of poisonous fumes into the atmosphere, may destroy the neighbouring forests. The mountains surrounding Queenstown, Tasmania, were originally covered with luxuriant forest, which has disappeared mainly as a result of poisonous fumes from large chemical works. With the adoption of new processes in the works and the cessation of discharge of chemical fumes into the atmosphere, regrowth of the forest has commenced. Meanwhile, the rain rushes down the bare mountains and subjects the King River to violent fluctuations which causes difficult problems of control for hydro-electric purposes.

[1533]. 91.3 (79.4) : 97. TALBOT, M. W., and KRAEBEL, C. J. **Relation of forest lands to agriculture, industry, and people in Southern California.** *For. Res. Note Calif. For. & Range Exp. Sta.* No. 39 (revised), 1945. pp. 6.

Southern California, which supports 50 per cent. of the State's total population, has only 2 per cent. of the State's total water supply, and shortage of water is the limiting factor of expansion in this area. The region also has a serious flood problem and consequent heavy erosion. The bulk of forest cover is of the chaparral type, which covers some 5 million acres of mountain catchments. Forest management resolves itself essentially into ways and means of obtaining from the local brush-covered catchments the maximum yield of usable water without excessive erosion. The major features of catchment-improvement work now in hand are: (1) increased protection from fire; (2) cover improvement; (3) road improvement; (4) torrent training. In newly burned areas and areas in which cover has been depleted by repeated fires and erosion, treatment is needed to hasten control of the soil by vegetation. This is done chiefly by direct sowing of mustard from aircraft, which protects the soil during several years while the chaparral is growing back. Badly placed roads and failure to stabilize soil disturbed by road making are fruitful causes of erosion and further research is needed to develop better methods of reducing damage from mountain roads.

91.5. *Value of the Forest for Colonization*

[1534]. 91.5 (47.1) : 94.3. BJÖRKHEM, K.E. Finlands kolonisationsproblem. **[Finland's colonization problem.]** *Skogen* 33 (11), 1946 (177–9). [Sw.]

Cf. *For. Abstr.* 7 (No. 2177).

91.8. *The Forest as a Source of Employment and Income*

[1535]. 91.8 (410). **Forestry as a career.** Forestry Commission [25 Savile Row, London, W.1] 1945. pp. 4.

A leaflet giving information on the various grades, necessary qualifications, means of training, and rates of pay of forestry work in Great Britain.

92. FOREST LAW

See also *For. Abstr.* 8 (No. 1367).

[1536]. 92 (410). ADKIN, B. W. **Poplar trees causing damage.** *Quart. J. For.* 40 (2), 1946 (109–10).

A note on a recent action brought for damages for injury by the roots and branches of Poplar trees growing on the defendant's land. It was claimed that damage was done by the roots of the trees to a water service pipe, an electric service pipe, and a concrete garden path, and that the roof and chimney of a house were damaged by overhanging branches. Judgment was given for the plaintiff for the amount claimed, and an injunction was granted, restraining the defendant from allowing the trees to do damage to the plaintiff's property. A similar case is cited. In both cases it was held that, where roots of a tree spreading underground have caused damage to an adjacent owner's property, the law is the same as when damage has been done by overhanging branches. The encroachment does not constitute a trespass, but a nuisance, and the person whose property is injured is entitled not only to abate the nuisance (e.g. in this case the plaintiff had cut down 2 of the trees) but also to recover damages for nuisance from the owner of the land on which the tree stands.

[1537]. 92 (485). BOGREN, G. Skogsstyrelsens förslag till ny skogsvårdslag. **[Proposals of the Forestry Board for a new forest conservation law.]** *Skogen* 33 (14; 15), 1946 (223–4; 236–7). [Sw.]

[1538]. 92 (54.1) : 94.3. **Bengal Act XI of 1945: the Bengal Private Forests Act, 1945. An act to provide for the conservation of private forests and for the afforestation in certain cases of waste-lands in Bengal.** With [typescript] statement of objects and reasons. Legislative Department, Government of Bengal. 1945. pp. 26 + 2.

[1539]. 92 (71.4) : 52.4 : 09.4. SMITH, J. Un nouvel amendement aux règlements du mesurage. **[A new amendment to scaling regulations.]** *For. québec.* 11 (5), 1946 (332–3). [F.]

The Minister of Lands and Forests in Quebec has issued new regulations on the subject of scaling on Crown lands. In future all surveyors must furnish 5 copies of a report, in standard form, on every operation. The Bureau of Mensuration and Classification of Timber at Quebec will use the original reports for compiling complete records of exploitation on Crown lands. Other copies will go to the licensee, the operator, the sub-operator (if any), and the last will be retained by the surveyor.

[1540]. 92 (729.2). JAMAICA. **A summary of the legislation of Jamaica relating to agriculture and forestry.** *Bull. Dep. Sci. Agric. Jamaica* No. 33 (*n.s.*), 1944. pp. 35 + index.

This publication brings together all legislation dealing with matters agricultural or akin to agriculture, land settlement, forestry, marketing, etc., earlier than 31st December, 1943. In most cases a short summary indicates the nature of the law, with rather fuller details of those laws with which the Government officer, planter or farmer is likely to be concerned.

[1541]. 92 (73) : 97.1. U.S.A. **1945 summary of outstanding federal and state legislation affecting rural land use.** *L.E. Bull. U.S. Bur. agric. Econ.* No. 71, 1946. pp. 127.

[1542]. 92 : 96.4 : 96.5. LUNCZ, G. Die Gesetzgebung über die Aufforstungskosten von Ödländereien. [**Legislation on the costs of afforestation of waste lands.**] *Intersylva* 1, 1940–1 (71–86). [G.e.f.it.span.]

With reference to Belgium, Brazil, Bulgaria, Canada, Chile, China, Denmark, Finland, France, French Morocco, Germany, Great Britain, Greece, Guatemala, Hungary, Italy, Japan, Jugoslavia, Lithuania, Madagascar, Mexico, Portugal, Rumania, Spain, Sweden, Turkey, Union of South Africa, U.S.A., Uruguay, and Venezuela. The treatment is of the text of the laws and not necessarily of their comparative results.

94. FOREST OWNERSHIP.
CO-OPERATIVES

[1543]. 94 : 90. ORCHARD, C. D. **The function of the state in the management of crown and private forests for the production of an assured supply of wood for industry.** *For. Chron.* 22 (2), 1946 (100–9).

The writer assumes the primary objective of forestry to be management for sustained yield and conceives the function of the State in attaining that objective to be: (1) To provide educational facilities for the training of foresters. (2) To impose minimum standards of competence for the forestry profession, or to give and encourage the profession to impose such standards. (3) To impose on private industry and owners the minimum of regulation necessary to ensure that mismanagement of privately owned or controlled forest lands shall not jeopardize the over-all provincial or national sustained-yield management plan. (4) To own and manage its own forest lands in at least sufficient acreage to make good the deficiencies in supply caused by private owners practising sustained-yield management, and so to manage its own lands that they will be an outstanding example to all other operators. (5) To assume and discharge the responsibility for certain fundamental requirements of sustained-yield management that cut across all boundaries of ownership, such as protection from fire and insects, basic research, maintenance of laboratory facilities, and a comprehensive and accurate forest inventory.

[1544]. 94.3 (410). **Dedication of woodlands.** Forestry Commission, 25 Savile Row, London, W.1. 1946. pp. 8.

An explanatory leaflet on the scheme for dedication of woodland, in the United Kingdom, including an application form for owners considering dedication.

[1545]. 94.3 (410) : 94.4. GRANT, J. R. **The problem of the small woods.** *Quart. J. For.* 40 (2), 1946 (90–2).

The writer urges the impracticability of owners of small woodlands in Great Britain being able to put their woodlands into order economically. A possible solution lies in the direction of Co-operative Forestry Associations, but after several years' experience in running such an association, he concludes that they have little hope of real success without help and encouragement from the Forestry Commission, and outlines a scheme for their future running. It is proposed that owners who cannot cultivate their woods should be invited to enter into a contract with the Forestry Commission with the following provisions: (*a*) The owner would hand over management to the Forestry Commission. (*b*) The Commission would pay nothing for the land or the standing timber, would receive money from sales, and would pay all the costs of maintenance and improvements. (*c*) A separate money account would be kept for the woods on each estate and interest at a low rate (say 2½ per cent.) would be added to the accumulated credit balance or accumulated deficit each year. (*d*) The owner of the estate might at any time take back into his own hands the management of the woods if he is prepared to 'dedicate' them. He would then have to

pay to the Commission the debit balance on the account, or would be entitled to receive a credit balance if there was one.

As the structure of the Forestry Commission is not adapted for handling small scattered woods, it is proposed that their management should be placed in the hands of local co-operative forestry societies, which would keep accounts for each estate and charge a share of its overheads. Net receipts on account of these estates would be handed over to the Forestry Commission, and net expenditure would be met by the Commission.

[1546]. 94.3 (71) : 95 : 96. JOHNSON, R. S. **Planning for managed privately owned commercial forests.** *For. Chron.* 22 (2), 1946 (138–46).

The writer argues that it is to the public interest that public aid should be given to private forest owners in Canada to enable them to manage their forests for sustained yield. This should take the form of adequate fire protection, assistance in the cost of making inventories, construction of permanent road and rail facilities, research (particularly in silviculture), long-term financing, modification of taxation, and some system of forest insurance.

[1547]. 94.3 (71.4). DELISLE, R. Petits et moyens propriétaires forestiers. **[Small and medium sized forest holdings.]** *For. québec.* 11 (5), 1946 (379–81). [F.]

Notes on the distribution of productive forest in Quebec in the hands of farmers and other small owners. At least 120,000 or 77·6 per cent. of all farms have some woodland. About 6,100 sq. miles of forest are owned by private small holders or corporations (club, social and religious institutions, municipalities, industrial companies, etc.).

95. FOREST TAXATION, LOANS AND INSURANCE

[1548]. 95.1 (73) : 22.14.2. [WOHLENBERG, E. T.] **Effect of tax laws on sustained yield forestry in the United States.** *B.C. Lumberm.* 30 (3), 1946 (47–8).

Between 1920 and 1930, the first reforestation laws made it possible for an industry to hold cut-over lands at a tax of 3 to 5 cents per acre per year while a new crop was growing, with a yield tax payable when it was cut. The 'accelerated depletion' concept, introduced in 1938, favoured selective logging, allowing the operator to charge as depletion the greater part of the value of a stand, even though 20 per cent. or more of the lower-value volume might be left standing for later cutting. In 1942 the Bailey Amendment to the Income Tax laws was passed; this allows the operator to write off the *fair market value* of his annual cut instead of the much lower *cost value*.

A brief analysis is made of the amount of capital investment and quantity of merchantable timber that are desirable, and it is concluded that a company which has an investment of about $50.00 per 1,000 bd. ft. of annual production and which holds about 35 years' cut of mature timber is usually in the most favourable financial position.

In discussing the details of the accelerated depletion concept, it is pointed out that, in more than three-quarters of the United States, selective logging is possible and in general use. An example is given of an operation in which 60 per cent. of the volume was removed of a value equal to 90 per cent. of the total. At $3 per 1,000 bd. ft. value, this meant that for every 1,000 bd. ft. cut, the owner could write off $4.50, and that the residual stand of 40 per cent. of the total volume has a book value of only 75 cents per 1,000. Thus his investment is reduced to a very small amount and he is able to carry the partially cut stand until it again becomes economic to cut.

Examples are given of the working of the Bailey Amendment. The savings made in this way are theoretically, but not compulsorily, available for the practice of forestry. Congress passed the Amendment mainly because of the promise of better forestry, but if the law is abused, Congress will undoubtedly rescind it, with resulting loss to the lumber industry.

[1549]. 95.1 (73) : 92. DEVRIES, W., and MASON, I. J. **Estimated national forest contributions to local government in Oregon and Washington under a modified plan.** *J. For.* 44 (6), 1946 (411–8).

A Bill now before the United States Congress prescribes a revised plan for determining the amount to be contributed to a State in lieu of taxes on account of national forest lands situated therein. In the present article, the plan is applied hypothetically to the national forests

of Oregon and Washington. The results are presented in some detail. Moderate increases in total amount of contributions and substantial differences in the distribution among counties are indicated.

[1550]. 95.1 : 66 : 62. MALLET, J. Principes de la taxation des parcelles dans les futaies jardinières. **[Principles of taxation of compartments in selection forest.]** *Rev. Eaux For.* 80 (11), 1942 (497–506). [F.]

The author discusses the principles of taxation of single compartments of selection forest and concludes that a suitable basis for taxation is provided by the formula $KvV\ (1 + t)^{2n}$ where v = volume per ha., V = total volume at the time of the inventory, t = rate of increment of the stand, and n = number of years to elapse between inventory and exploitation. K is a constant determined by the condition that the total volume obtained by multiplying the rates of taxation by the total volumes of each compartment shall be equal to the total yield capacity for the whole rotation.

96. POLICY REGARDING PROTECTION FOREST AND DEFORESTATION

See also *For. Abstr.* 8 (No. 1542).

[1551]. 96.3 (61 : 62 : 64 : 65). BUFFAULT, P. Le déboisement de l'Afrique du nord. **[The deforestation of North Africa.]** *Rev. Eaux For.* 79 (7), 1941 (471–87). [F.]

[1552]. 96.5 (44). PRAX, J. Le reboisement: ses divers aspects. Esquisse d'une politique nationale du reboisement tirée de l'expérience des Cévennes méridionales. **[Various aspects of reforestation. Sketch of a national reforestation policy drawn from experience in the southern Cévennes.]** *Rev. Eaux For.* 84 (4), 1946 (177–200 + plates). [F.]

After giving a brief account of the social, political and economic causes which have led to the depopulation of many rural areas of France and the reversion of much cultivated land and pasture to waste, the writer outlines a plan for reforestation of a minimum of 450,000 ha. The proposed scheme would entail the acquisition of the land in question by communes or the State after a public inquiry, planting to be carried out over a period of 45 years. Such a project would necessitate the importation of labour and the manufacture of planting machines.

97. POLICY REGARDING THE RELATION OF THE FOREST TO AGRICULTURE, PASTURE, AND INDUSTRY

[1553]. 97.1. JACKS, G. V. **Land classification for land-use planning.** *Tech. Commun. imp. Bur. Soil Sci.* No. 43, 1946. pp. 90. Price 4*s.* net.

Land classification must form the basis for the planned utilization of land. Interest in land-use planning as a means of avoiding the economic disasters that overwhelmed agriculture before the war and the land deterioration that resulted from faulty land use, and, on the international scale, of securing a better balance between the supply of and demand for agricultural products has become world-wide. Yet the science of land classification is still in its infancy. It is essential that everybody engaged in land-use planning, whether in the field or in the office, should know the basic principles of land classification so far as they have been developed, what the classifier aims to do, what factors—geographical, social and economic—are involved, and what are the limitations of land classification.

These matters are discussed in this Technical Communication, which is a summary of the published literature on land classification so far as it concerns the planning of agricultural and forest land. In addition to a review of general principles, numerous examples are given of actual systems of land classification, and a section is devoted to the several schemes for quantitatively expressing soil productivity, known as 'productivity ratings' in America and *Bodenbonitierung* in Germany.

[1554]. 97.1 (410). PORTSMOUTH, EARL OF. **Alternative to death: the relationship between soil, family and community.** Faber and Faber Ltd., 24 Russell Square, London. 1943. pp. 188. Price 8*s.* 6*d.*

The theme that there is no alternative to death except to seek adjustment in humility with nature is developed in essays on: nature, the family and the nation; the need for interest-free national long-term credit for agriculture; retrospect on land tenure; death duties and the

principles of its personnel; rural life and opportunity; forestry and farming; ecological comity.

[1555]. 97.1 (54.2) : 96.5. CHATURVEDI, M. D. **The constitution of the Land Management Circle, United Provinces.** *Indian For.* 72 (4), 1946 (165–8 + plates).

The formation of fuel and fodder reserves constitutes an important part of the land management programme of the Land Management Circle of the Forest Department of the United Provinces created in November, 1945. The circle proposes to acquire about a million acres for fuel and fodder reserves in the next 10 years. Other proposed activities include: (1) the afforestation of State lands such as canal banks, roadside avenues, camping grounds, compounds of public buildings, railway lands, acquired lands, *nazul* lands, and lands belonging to public bodies; (2) control of erosion and the reclamation of denuded areas; (3) the utilization of *usar* (saline) and *bhur* (sandy) soils; and (4) advising on the management of groves, court of ward lands, and lands belonging to *zamindars* and tenants.

[1956]. 97.1 (54.5) : 96.5. KHAN, A. A. **Utilization of degraded *rakhs*.** *Indian For.* 72 (5), 1946 (213–25 + plates).

A discussion on 'the existing condition, potential usefulness and policy and programme of work to be followed to get the maximum sustained benefit out of the degraded *rakhs* in the Punjab'. The total area of the civil *rakhs* (waste Government land managed as forest or grazing ground by the Revenue Department) is 2,718,653 acres, of which 929,810 acres is possibly capable of cultivation. The remaining 1,788,843 acres (and perhaps some out of the cultivation group) are available for grazing, grasslands, and small timber and fuel reserves. At the time of their reservation, the *rakhs* consisted chiefly of fairly well wooded scrub forest, but excessive grazing and browsing and illicit fellings, combined with uncompensated natural mortality, has caused severe denudation. Three main classes of land are recognized: (1) In flat or gently sloping areas suitable for irrigated cultivation it is recommended that 10 per cent. of the ground and 10 per cent. of the water supply should be dedicated to fuel plantations, shelterbelts and avenues. (2) In lands suitable for *barani* cultivation security of tenure is the essential need. This could be assured by a definite promise of occupancy rights after the first 10 years and ultimate proprietorship after payment of *malkana*. It is suggested that the *rakhs* should be divided into 75-acre holdings: one-third for gradual conversion into properly terraced and bunded land for cultivation; one-third under grass, and one-third under trees. (3) Areas unfit for cultivation should be taken over by the Forest Department and managed as fuel and fodder reserves for the neighbouring villages. The main problems in establishing woodlands in the semi-desert *rakhs* are: impoverished soil; inadequate, erratic and shortlived monsoons; devastating autumn and summer drought; and severe winter frosts. These dangers are reduced by: proper choice of species; early sowings and pre-treatment of seed; sowing both at the bottom and on the berm of contour trenches; weeding, hoeing, and mulching; and the use of phosphatic manure to accelerate the root development of tender seedlings.

FORESTRY THE WORLD OVER

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Australia. The Victoria Forests Commission has drafted a two-year programme of urgent work, involving an estimated expenditure of nearly £4,000,000, which includes £1,250,000 on fire protection, £750,000 on silvicultural maintenance works, £700,000 on road building to open up hitherto inaccessible stands and facilitate extraction of timber, and £950,000 on afforestation. Much of the productive timber land in this State is situated in mountainous country where harsh climatic and difficult working conditions exist, and which is generally remote from organized centres of settlement. A definite policy has now been adopted of excluding sawmills from the forest and encouraging their establishment in neighbouring country towns, preferably adjoining a railhead. In the opening up of some forest tracts in remote areas, every effort will be made to promote the establishment of the sawmills drawing their log supplies from the area as the nucleus of new forest townships in convenient locations, instead of having isolated sawmills scattered through the forest as in the past. This should bring about a proper integration of the timber industry by making possible the economic establishment of secondary manufacturing plants, such as seasoning kilns, planing and dressing mills, joinery works and wood-using industries.

The recovery of sawn timber from the forests killed by fire in 1939 continues steadily. Though the target of 916 million super. ft. was passed last May, two months ahead of schedule, fire-killed Mountain Ash [*Eucalyptus regnans*] is still making a good contribution to the supply of timber for building and manufactures. The total volume of fire-killed timber recovered now amounts to 1,040 million super. ft., and this will be much exceeded before the dead trees cease to be a factor in Victorian production. The increase above the original estimate is mainly due to the excellent system of roads which has been established. With good roads, not only is volume of recovery increased, but a wider range of products can be taken out. Pulpwood, for example, will be extracted from the dead forests for some time to come (**1**; May 1946).

Experiments with the use of Pine sawdust as a soil-builder in the Moss Vale-Mittagong region have shown that where the sawdust was thoroughly incorporated with the soil, subsequent vegetable crops did particularly well. The sawdust should be thoroughly mixed with the soil by a cultivator or rotary hoe, and not ploughed in, nor left in a layer where it could harden and block root growth. In one instance, half an acre of nursery being used to raise *Phlox* for seed purposes was divided in two, and one-half treated with *Pinus radiata* sawdust at a rate of 12 tons to the acre. Germination of seed was about 50 per cent. better and the subsequent growth of the plants 25 per cent. better on the treated than on the untreated area. Experience shows that hardwood sawdust is of no value at all. It is important to remember that when sawdust is applied to the soil, the soil population of micro-organisms increases in order to break up the sawdust. These micro-organisms use up soil nitrogen, and farmers should be advised to counteract the resulting nitrogen deficiency by applying about 1 cwt. of ammonium sulphate per acre (**11**; March 1946).

In Australia, wood flour has been made in both impact (hammer) and abrasion mills, and is used chiefly in the manufacture of linoleum, plastic moulding powders, and explosives. There are plants at Sydney and Melbourne, but their capacity is insufficient to meet the expanding demands of these industries. Local factories originally used sawdust derived chiefly from the sawing of imported logs and flitches of Douglas Fir, Hemlock and Spruce. Attention is now being paid to *Pinus radiata* and *Araucaria cunninghamii* as the most suitable Australian woods. If plants could be suitably

placed with relation to supplies of dry sawdust of these species, Australia should become self-supporting in wood flour (7; May 1946).

Experiments at the Forest Products Laboratory at Melbourne have recently been carried out to determine the usefulness of lignin-filled pulp sheets as plastic overlays for plywood, thus eliminating some of the natural disadvantages of plywood, such as its tendency to check when exposed to the weather. The process, though promising, has several drawbacks, such as the relatively high laminating temperatures and pressures required. It is hoped, however, that the disadvantages may be eliminated by using the lignin in combination with small amounts of phenolic resin (7; May 1946).

Tests are in progress at the Munitions Supply Laboratories on various fire-retardant coatings. Strips of the coated wood are stacked in a tier, surrounded by a shield, and subjected to a standard flame for a specified time. Observations are made of the rate of burning, of the time elapsing before flaming ceases, and of the time required for complete extinction. The effectiveness of the coatings is assessed on the residual weight of the charred residue (expressed as a percentage of the original weight of the coated wood), as well as on visual observations. Investigations are in progress to ascertain which Australian timbers would be suitable for use as standards for the exposure testing of paints on wood. The paint-holding properties of timber depend not only on the species of wood but also on individual differences in such things as direction and texture of grain, spacing of annual rings, and density, which can exert as great an effect as differences between species. It is proposed to investigate the effect of these variables on two species. As climatic conditions, at the time of application and during subsequent exposure, play a large part in the durability of the film, panels will be prepared and exposed in both Melbourne and Sydney (1; June 1946).

Austria. Austria's pulp and paper industry is operating at only 40 per cent. of capacity. During the war the Germans cut down large forest areas and since the end of the war further large quantities have been felled for firewood. It is believed that 3 to 4 years will elapse before sufficient wood is available for the industry. This situation may considerably affect export policy. Before the war, 50 per cent. of the pulp production was exported, but the trend of policy now is towards building up the export of the finished products, such as paper and cardboard, rather than the shipment of wood pulps (6; 10.8.46).

Brazil. The Cashew-nut industry is being developed in Brazil. A machine has been designed that shells the nuts without injuring them and at a lower cost than by hand-shelling. A moderate industry is also developing in Cashew-nut oil, some of which has been exported. The Cashew nut (*Anacardium occidentale*) is native to the north-east coast of Brazil, and grows on almost any type of soil, including sand dunes. The tree flowers in August or September, and the fruit ripens from November to February. While most foreign countries appreciate the Cashew for its nut, Latin Americans value it for its fruit, which is soft, juicy, acid, and highly astringent before maturity. It is eaten raw, and a refreshing beverage known as 'cajuada' is made from it. Wine is manufactured commercially from it in Northern Brazil, and the fruit is preserved in various forms as an article of commerce. (6; 10.8.46).

Canada. Sowing of Fir and Cedar was started recently at the new British Columbia Duncan nurseries of the B.C. Forest Service. Sowings are made broadcast, each worker spreading the seed by means of a bottle with a hole in the cap. The seed is then covered with a half-inch of sifted soil. Shade frames giving 50 per cent. shade are then laid over the beds; these are made of spaced lath, in 50-ft. rolls, the length of the beds. Planks forming the bed frames are lifted after the trees are a year old, and used for fresh beds. A root-pruning machine drawn by a caterpillar tractor and using a sharp serrated blade powered by an engine, is then employed to cut tap-roots. This is a great saving since, previously, yearling trees had to be lifted, pruned, and replanted (12; July 1946).

Since the development of Spruce budworm attacks may be connected with the number of 'staminate' Balsam Firs, as those of Jack Pine budworm have been shown to be connected with the number of 'staminate' Jack Pine trees [see *For. Abstr.* 8 (No. 705)], investigations into the number and nature of such trees are to be made on the Green River. The 'staminate' tree appears generally to be one which has for a number of years produced cones as well as staminate flowers. Twigs

bearing flowers appear to become more or less exhausted, particularly those bearing cones. Shoot growth of the year following flowering is generally short and sometimes one or two years elapse before another heavy crop of flowers is produced. Whether this periodicity is characteristic of trees or of stands remains to be determined. Multiplication of the budworm may be greater on 'staminate' trees because of the value of the flowers or their pollen as food (as is the case with the Jack Pine budworm), but it might also be due to inherent qualities of the foliage of the trees, associated with their slower growth. Significant data must first be obtained to prove the existence and the degree of this effect on budworm development and multiplication. If it exists in an important degree and flower production is primarily a result of increasing age, this will support the recommendation that mature and overmature stands of Balsam should be removed to reduce budworm hazard. If site proves to be a more important factor than age, the hazard might be measured by the number of 'staminate' trees (possibly indicative of physiological age) rather than by years of age (**2**; May-June 1946).

A large new pulp mill is planned for Blind River, Ontario, as a joint project of the Ontario Government and the J. J. McFadden Lumber Co. The McFadden lumber mill has an annual capacity of 100 million bd. ft. By the combination of lumber mill and pulp plant it is hoped to attain complete, or almost complete, utilization of wood products. Cutting will be done for both pulp and lumber on the Mississauga limits, with the river providing easy transport for both (**12**; August 1946).

A modern logging camp is under construction near the Franklin River, British Columbia. It will provide accommodation for 80 families and for 350-400 men who will work at the camp. A sewerage system, plumbing, electricity, and central heating are being provided. A two-room school building and a recreation field are mong the amenities. The camp is expected to be finished in about 18 months' time, and to be in use for a period of 15 years (**6**; 14.9.46).

Ceylon. The Ceylon Board of Ministers' post-war programme contains proposals for the establishment of two more plywood factories. The island's consumption of plywood chests is between 2 and 3 million a year, and the capacity of the present Government plywood factory at Gintota does not exceed one-quarter of a million a year. It has been found that the finest grades of plywood can be manufactured from most of the wet-zone timbers in the island (**13**; 17.9.46).

Czecho-Slovakia. Through the confiscation of property previously held by Germans, the area for which the Department of State Forests is responsible has been increased to one million hectares. The Government has allocated a sum equivalent to about £900,000 for the purchase of vehicles, tractors, and other mechanical equipment. Afforestation plans for the coming year provide for the planting of 9,500 ha. and for raising seed on about 150 ha. (**13**; 5.10.46).

Eire. The Irish Timber Development Co., Dublin, has been formed in Eire for seasoning and hardening green timber by a new process taking only a few minutes. According to the inventor of the process, seasoning takes place by the self-impregnation of the wood with its own resin, which becomes liquefied and fuses into the cellulose fibre. A uniform surface results, making planing unnecessary, and taking a high polish with ordinary sandpaper. It is claimed that both soft- and hardwoods can be seasoned in less than 2 minutes, and inexpensive woods may be put to uses for which they would not otherwise be suitable. Sterilization of the wood occurs in the process, thus rendering it impervious to insects or rot. By controlling temperature and pressure, any desired shade of colour may be given to the wood (**6**; 17.8.46).

Finland. A Finnish forester has patented a process for artificially producing a curled or wavy figure in wood. The best results are obtained with Birch, but the process has also been successfully applied to Grey and Black Alder (**9**; Sept. 1946).

Greece. Production of turpentine in the 1945–46 crop year declined to one-tenth of the normal output of 55 million lb. Although some 4 million trees out of a pre-war total of 11 million were destroyed during the period 1940–45, the decline is largely due to shortage of equipment, lack of transport facilities, and the unfavourable price situation. The turpentine which is being produced is also very inferior in quality (**6**; 14.9.46).

Guatemala. Exports of chiclé from Guatemala in 1945 amounted to 4,081,162 lb., an increase of 63·7 per cent. on the 8-year average 1937–44. The gum is extracted from Chico-Zapote [*Achras sapota*]. During the tapping season, from 4,000 to 5,000 chicleros are usually employed. Many of them are brought from Mexico and British Honduras. Use of air transport has been the chief factor in the growth of the chiclé industry in the Peten area. There are 13 airports in the district, which transport chiclé and deliver supplies to the chicleros working in the jungle (**6**; 13.7.46).

Italy. More than 2,000 acres of timber in the immediate vicinity of Trieste, and at least 2,500 more in Venezia Giulia have been devastated since 1941. A programme to reforest and protect the devastated areas was initiated in March of this year. Plans prepared by the Allied Commission are being carried out by the Venezia Giulia Forestry Corps. Projects include preparation, planting, fencing of planted areas, terracing and construction of dams on eroded areas, and the establishment of three nurseries (**8**; July 1946).

Italy has been allocated 1½ million dollars by U.N.R.R.A. to import 20,000 metric tons of lumber during the first half of 1946. Before the war, Italy supplied about 60 per cent. of her own lumber requirements, the remainder being imported from Norway, Sweden, Yugoslavia, and Austria. Heavy demands for repairing war damage are resulting in serious depletion of timber reserves. U.N.R.R.A. is also assisting the Italian Government in its plans for rehabilitating Italian forests (**6**; 13.7.46).

Japan. The loss of Karafuto, the southern end of the island of Sakhalin, together with the loss of imports of both pulpwood and wood pulp, considerably reduces the raw material available to the Japanese pulp and paper industry and other users of pulp. More than one-half of the total production of pulpwood used in Japan during the 10-year period up to 1945 was concentrated in Karafuto. Of estimated forest resources of 67 million cu. ft. in Japan proper, 19⅕ million cu. ft. in Old Japan and 8½ million cu. ft. in Hokkaido, are composed of species commonly used for pulping. The preferred species are Hemlock, Spruce, Red and Black Pine. A maximum output of nearly 900,000 short tons of wood pulp was attained in Japan proper in 1941. An estimated production of 600,000 short tons from remaining pulp-production capacity appears to be the maximum reasonable possibility after bomb damage is repaired and sufficient coal, wood and chemicals are obtained. Bomb damage was not severe, as most large plants are situated away from heavily raided areas (**6**; 17.8.46).

Mozambique. Enough wood for the construction of 10,000 houses is to be imported into South Africa from Mozambique, which possesses magnificent forests of Mahogany and other valuable species near the sea in the tropical region (**9**; Sept. 1946).

Norway. The Norwegian chemical pulp industry is expected to operate throughout 1946 at 30-40 per cent. of capacity. The mechanical pulp mills are operating at only 20–25 per cent. of potential. Paper-mill production is higher, the average being about 55 per cent. Estimated production from July 1, 1946, to June 30, 1947, in metric tons, with 1937 figures in brackets, is as follows: mechanical pulp 450,000 (1,300,000), chemical pulp 250,000 (564,000), paper and board, including newsprint, 325,000 (623,000). The capacity of the pulp and paper industry is about the same as before the war. Good progress is being made in overcoming some wartime difficulties, such as the lack of boots, clothing and other supplies for forest workers. The pulpwood supply remains the greatest single difficulty of the industry. Norway's volume of standing timber increased during the war by an estimated 7 or 8 million cu. m. because of the low rate of cutting. An average conservative estimate of the pulpwood cut for the 1945–46 season is 2 million cu. m., and the normal requirement of 4 million cu. m. will probably not be reached until the 1947–48 season (**6**; 31.8.46).

A Central Committee for Research on Forestry and the Forest Industry [*Skogbrukets og Skogsindustriens sentralkomité for Forskning*] has recently been set up, and the possibilities are being examined of establishing a research institute for the timber and wood-using industries (**10**; 1.9.46).

Rumania. Rumania's pulp and paper industry normally includes 6 wood-pulp mills, 8 paper mills, and 6 paper-board plants. At present only two wood-pulp mills are operating, with a capacity of 46,000 metric tons per year, of which 41,000 tons are sulphite and 5,000 tons sulphate. Experiments were made during the war in the use of rushes and reeds, of which great quantities are available

in the Danube swamps. It is believed that, with sufficient machines to cut and press the plants, the cost would be very low, and Rumania's coniferous forests would not have to be the sole source of raw material for paper-making (**6**; 6.7.46).

South Africa. To provide building timber, the Minister of Agriculture has decided to increase the log-cut in South Africa by 2½ million cu. ft. during the coming year. The volume of softwood logs felled in State plantations has exceeded the normal cut by about 8 million cu. ft. during the last 4 years (**13**; 7.9.46).

A new timber processing factory is to be built at Colenso, South Africa, and will make a patent hardwood board for use in building. The raw material will come from the Province's large Wattle plantations (**16**; Sept. 1946).

Sweden. Fellings of cordwood in the year ending June 30, 1946, were the heaviest since 1942–43 (total 52·6 million cu. ft.), amounting to 46 million cu. ft., of which 31·8 were fuelwood and charcoal wood and 14·2 were pulpwood and pit props. The totals for 1943–44 and 1944–45 were 41·7 and 35 million cu. ft. respectively (**10**; 1.9.46).

Additional facilities for cellulose research are being established in Sweden. Svenska Cellulosa AB. has completed a laboratory for timber research at Kubikenborg at a cost of 2,500,000 kr. Lignin will be one of the principal subjects for study at a laboratory to be constructed by Mo och Domsjö AB. (**6**; 10.8.46).

A survey of forest resources and depletion in the county of Västerbotten shows that between 1925 and 1945 the standing volume of Scots Pine sank from 90 to 80 million cu. m., that of Norway Spruce from 79 to 67, and that of hardwoods from 36 to 25 million cu. m. Fellings of the conifers have exceeded increment by 30 per cent. The committee which publishes these findings proposes that the cut for the next 20 years should be reduced to about 80 per cent. of the increment, which will mean a reduction of 1½ million cu. m. per annum in the output of industrial timber. The situation in Norrbotten appears to be as precarious as that in Västerbotten, and a reduction of the cut to between 76 and 93 per cent. of the volume increment, or to about 60 per cent. of the present cut, may be necessary (**10**; 15.9.46).

Turkey. The total area of Turkish forests is believed to be nearly 9 million hectares (about 22½ million acres), or 11½ per cent. of the area of the country. The proportion of softwoods and hardwoods in the general forest areas is probably about 54·5 per cent. and 45·5 per cent. respectively. Among the more important timbers are Red and White Oak, Beech, Ash, Chestnut, Pitch Pine, Cedar, and Poplar. A Government report of 1935 stated that there were '55 major installations for sawmilling, box manufacture, and railway sleeper production' in the country, and over 400 small forest sawmills. The great decrease in timber extraction from the forests in recent years has been due largely to transport difficulties.

As far as can be ascertained, there is practically no afforestation, conservation or fire protection in the Turkish forests, most of which are Government-owned. Cutting rights are sold by auction, and export of timber is forbidden except under licence, a different export licence being required for each kind of timber. Sales for export are in the hands of Government-appointed associations of exporters called Birliks. Since dealings through the Birliks immediately become public property, producers' prices tend to soar to fantastic heights (**16**; April 1946).

United Kingdom. A big future is expected for a new structural material produced by the British plastics industry. This material, known as Holoplast, was used in the first plastic-lined ship (the 'Empire Antigua') recently launched on Tyneside. Holoplast has many qualities which make it a perfect material for a ship's interior, i.e. for doors, walls, and non-slip flooring. It is unaffected by water, normal heat changes, most solvents, oils and organic and diluted mineral acids; is impervious to vermin and white ants; has exceptionally good insulation qualities and strength to withstand shock without bending or breaking; is non-inflammable and will not support combustion. The basis of Holoplast is a special kind of kraft paper impregnated with phenolic resin, which is curved in the ordinary way by heat and pressure (**12**; July 1946).

During this year considerable quantities of German logs have been imported and distributed to sawmills throughout the country. Some logs, shipped without removal of the bark, were infested with *Ips typographus*, which has hitherto been very rare in this country (**5**; Oct. 1946).

United States. Tests of the Sikorsky helicopter were recently made in California for the U.S. Forest Service by the U.S. Army Air Forces. It was easily controlled, steady in flight, could land and take off from a very small field, but could rise straight up and hover only to a maximum of 25 ft., which means that it could not be used for landing on small fields surrounded by tall timber. After a vertical climb of 25 ft. the helicopter must have a forward speed of at least 20 m.p.h. in order to climb further. The rate of climb increases until the maximum speed of 60 m.p.h. is reached, when the plane can climb 1,200 ft. per minute, which represents a 15-degree climb. The planes can carry a pay load of 400 lb., plus enough fuel for 200 miles, which gives them a range of something under 100 miles. The great advantage of these planes over conventional types is their ability to land on rough ground. One of the helicopters made a demonstration forced landing in the boulder-strewn bed of a river and was uninjured. The cost of a plane is about $50,000, which, when the comparatively short range and small pay load are considered, makes them too expensive for use at present. The price will have to come down to about $20,000 before it will be practicable to put them into even partial use in forestry work (**12**; July 1946).

The Crown Zellerbach Corporation of Portland, Ore., a big paper concern, began operations in October, 1945, for recovery of salvage material on the ground in cut-over areas. From an initial rate of one million bd. ft. per month, the rate of recovery had risen by May of this year to 6 million bd. ft. During the first 8 months of the operation, a total of 27 million bd. ft. was recovered from 1,000 acres of cut-over land. Six different species are being recovered from land previously logged with heavy equipment. Logs run from 6 to 44 ft. in length in all sizes from pulpwood to veneer logs. Equipment used consists of medium and small tractors and light yarder units. Experiments indicate that better loading methods are needed and that semi-trailers with stake bodies might be used with advantage. Most of the loads are coming to the river booming grounds over a 30-mile private forest road. At the dump the entire load is lifted from the truck at one operation by means of slings or wrappers, which form the binding of the loads when made into 'asparagus' rafts. Conventional log scaling methods cannot be used in these operations; instead, each load is weighed and the contractor paid on this basis. An integral part of a salvage operation for a pulp mill should be one or two portable mills to deal with charred logs which must not be sent to the pulp mills. These mills could easily produce 12–15 thousand feet of squared timber which would find a ready sale in the timber market (**14**; July 1946).

The new experimental plant at Springfield, Ore., for converting wood waste into alcohol, is shortly going into operation. Wood consumption will be at the rate of 221 tons dry wood substance per day. Wood waste will be delivered by rail in specially built waggons with side gates and inverted V bottoms to facilitate dumping. Sawdust, green shavings, and hogged wood will be used, and will be dumped into a pit from which the supply goes by conveyor to a screen which separates it into 3 sizes, with one reject overflow. The rejected material, consisting of splinters and over-size pieces, flows down into a hammer mill for reduction to proper size and return to the screen. From the screen the wood substance passes into three bins as sawdust or extra fine chips, as medium chips, or as large chips. An ingenious, integrated control over the whole transfer system from storage to percolator mouth has been installed on the top floor of the building, where the 5 percolators are fed. The end product will be some 11,000 proof gallons per day of ethyl alcohol. Residual products include 75 tons (dry basis) per day of lignin, about 800 gallons per day of methanol, 70 gallons per day of fusel oil, undetermined quantities of formic and acetic acid and furfural. Some 21 tons of calcium sulphate will be recovered every day through a Kelly filter installation, and will be sold as a fertilizer for acid soil. The carbon dioxide, about 40 tons per day, may be utilized for the manufacture of dry ice or synthetic methanol. Yeast of 50-per-cent. protein content for cattle fodder or poultry feed, in excess of alcohol-processing demands, may equal 10–20 tons per day. The economics of the plant are unknown, but the assumption, based on pilot-plant findings, is that for the next 3–5 years the main product, industrial alcohol, will pay its own way without any assistance from the sale of by-products. After that time, the development and installation of by-product processing should place this plant in a sound competitive position (**15**; July 1946).

The essential oils industry expanded greatly during the war when three-quarters of the usual imports were cut off. Besides the citrus plantations of the west, oils were obtained from the leaves of White Cedar [*Thuja occidentalis*] in New York State and Vermont, from the wood of Red Cedar [*Juniperus virginiana*], Pine, and Sassafras in the south-western States, from Sweet Birch [*Betula lenta*] in Pennsylvania and North Carolina, and from White Spruce and Hemlock (**4**; July 1946).

U.S.S.R. The new Five-year Plan for the timber industry demands a great increase in the timber-felling areas, particularly where water transport is available. Exports have hitherto been met mainly from the resources of European Russia, while at the same time large quantities of timber for domestic consumption have been transported by rail from Siberia. The policy in future will be to reserve the products of European Russian forests for domestic use, while exploiting the immense reserves of the Yenisei basin for export purposes. Only preliminary surveys have been made as yet, but estimates of about 167 billion bd. ft. have been made for the Yenisei valley itself, while reserves in the valley of its tributary, the Angara, are estimated at three times that figure. Logs from this huge reserve can be floated to the sawmills of Igarka, which provides a sheltered harbour where cargoes can be transferred to ocean vessels during the two-month navigation season when the Kara Sea is open.

Rationalization of timber transport requires that all the districts of the Eastern Donetz basin, North Caucasus and Trans-Caucasus should get their timber from the Kama, Volga and Vyatka basins. The Trans-Caucasus can best be supplied by towing rafts across the Caspian Sea. War-time practice has shown that round timber and firewood can easily be floated in rafts from the upper Volga and the Moscow–Volga canal to Moscow. In this way the railways will be for the most part relieved from transporting wood to the capital. The supply of timber to the Ukraine is difficult, owing to the immense quantities needed for restoration work, and besides that floated from White Russia supplies will have to be brought from Karelia. An increase in supplies for the Urals and Siberia must be obtained by the use of virgin forests and the development of local water routes hitherto unexploited, and local sawmills.

In order to convey ever-increasing quantities of timber to the waterways, the new Plan provides for the construction of thousands of km. of timber-transport roads, and over 6,000 km. of narrow-gauge railway, mainly in the Kama basin. It is intended that, by the end of the 5-year period, no less than 70 per cent. of the trucks and tractors for hauling timber shall be converted to the use of wood fuel, and that 75 per cent. of the total work of felling timber and hauling it to the roads, and 55 per cent. of the transport of timber, including loading facilities, shall be mechanized. It is expected that this should almost double labour productivity in the industry in the next 5 years (**3**; August 1946).

The Russian paper industry is gradually returning to normal operation. The new Five-year Plan aims at a production in 1950 of 1,340,000 tons of paper (65 per cent. more than in 1940), 250,000 tons of newsprint (192,000 tons before the war), 250 million kraft-paper bags for cement, fertilizers and food products (76 million in 1940), over 2,000 million school notebooks (present production is 700 million), 60 million cardboard containers and enough composition board to build one million sq. m. of housing. To assure the industry's continued expansion, it will be necessary to develop new methods and equip paper mills with modern machinery. Among the recent improved techniques will be the use of oxygen in the boiling of pulp, which will speed up the process by about 100 per cent. (**6**; 31.8.46).

Tung plantations cover an area of 750 acres in Azerbaijan, and it is hoped that by 1948 they will amount to 5,000 acres. The Azerbaijan Perennial Plants Institute has successfully cultivated the Tung tree, previously grown mainly in the humid subtropical regions of Georgia, in the dry sub-tropics as well. Recent experiments show that under these new conditions the Tung tree becomes hardier and ripens a month earlier than usual. Moreover, Tung trees grown in Azerbaijan are not affected by bronzing, which causes serious damage to plantations in Georgia (**6**; 14.9.46).

Transcarpathian Ukraine, which became part of the Ukrainian S.S.R. in 1945, has an area of 12,628 sq. km., of which 6,138 sq. km. are under forest. Annual production is estimated at over 2 million cu. m., of which 30 per cent. goes to industry and 70 per cent. is used as firewood. The forests are composed of 58·8 per cent. Beech; 25·4 per cent. Silver Fir; 7·9 per cent. Oak; 3·7 per cent. Spruce; and 4·2 per cent. other species (**6**; 24.8.46).

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2. To secure general recognition of the dependence of timber supply upon forest management.
3. To collect and circulate information relating to forestry and the commercial utilization of forest products.
4. To form a centre for all engaged in forestry.
5. To provide a means of communication between all concerned.

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